Trains

June

1944

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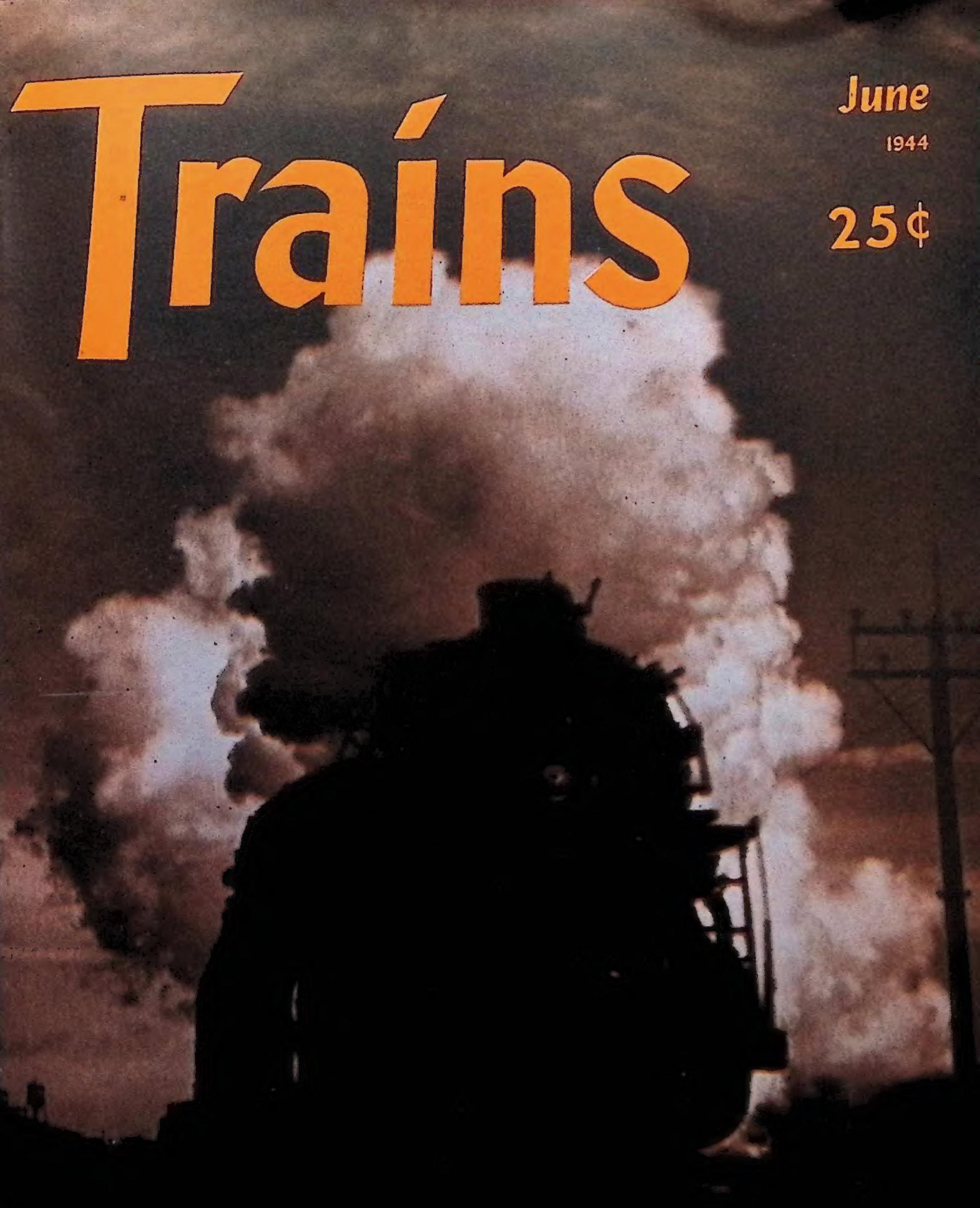

In This Issue: NYC Freight Line, Uruapan Express, Locomotive

IT'S a day coach. Looks pretty nice, doesn't it? And it is nice! Light, bright, roomy and comfortably air-conditioned. Smooth riding at high speeds with pillow-soft seats that fairly invite you to sink down and relax—wide windows that provide a sweeping view of the scenic landscape—and dozens of important little travel conveniences. • Where will you find such coaches as this? Many of them were built before the war began and are now in use. Hundreds more had been planned but never built—you know the reason why.

• We haven't been able to use scarce materials and man power to build trains as we'd like to have them. There's a war to win and we're doing our level best to meet the nation's war-time transportation needs. • But we offer this little glimpse of the future because we want you to know, when you ride on our trains today, that railroads are looking ahead, planning for better trains for tomorrow.

ASSOCIATION OF
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$375 in prizes!

TRAINS is sponsoring a contest with $375 in prizes for the best manuscripts on specific railroads. The object is to encourage new writers on railroad subjects and to stimulate interest in our railroads. Since the winners will be published in TRAINS, reader interest will be a prime factor in judging, and this means that emphasis should be on the present-day operations and plant of the railroad chosen. Any railroad anywhere, large or small, may be used as subject. Local color, personalities, geographic and industrial surroundings of the railroad all deserve inclusion in a good story of a railroad. The rules of the competition are:

1. The awards will be: First, $150; Second, $100; Third, $75; Fourth, $50. Tying awards or additional awards of $25 or more will be made if the judges deem other manuscripts worthy.

2. Each entry shall be devoted to a single railroad or railroad system and shall be a manuscript of from 3000 to 8000 words, exclusive of pictures, picture captions, lists and map data.

3. Manuscripts must be typewritten on 8½" x 11" unlined paper and double spaced, using only one side of the paper.

4. Manuscripts will be judged on completeness and accuracy of information, literary style, organization of material, photographic illustrations and supplemental material which will assist in an interesting presentation of the article. Entries submitted without accompanying photographs will be given full consideration.

5. All entries earning cash awards will become the property of the Kalmbach Publishing Co. Valuable photographs, maps, etc., receiving awards will be returned only after use and if their return is specifically requested. Return postage should be included in every case. The publisher cannot be responsible for safe return of entries.

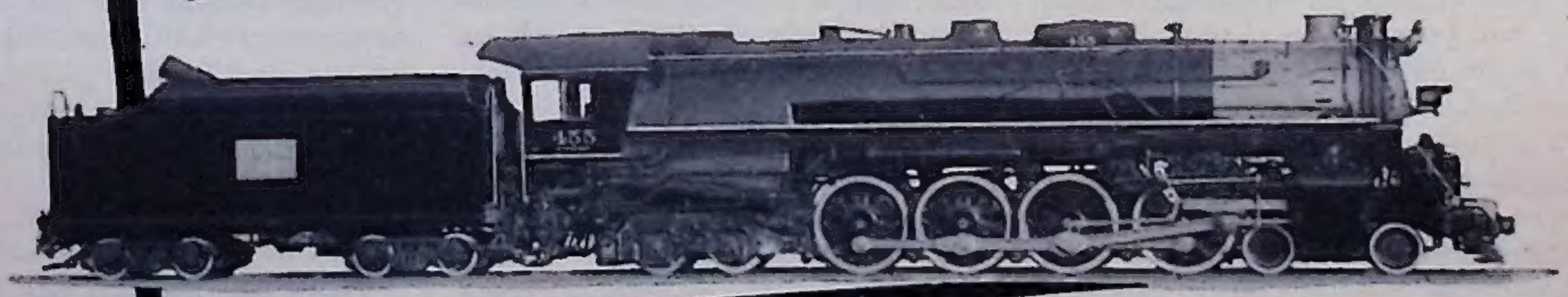
6. Entries must be addressed: Competition Editor, TRAINS Magazine, 1027 N. Seventh Street, Milwaukee 3, Wis. Do not include with your entries subscription orders or any correspondence not pertaining to the competition.

7. All entries must be postmarked by midnight September 4, 1944 (Labor Day).

8. Employees of the Kalmbach Publishing Co. and their families are not eligible.

9. Judges: Editors of TRAINS and Samuel O. Dunn, Editor of *Railway Age*.

8 NEW LIMAS for the CENTRAL OF GEORGIA



For The Central Railway Company of Georgia, Lima has recently built and delivered eight locomotives of the 4-8-4 class, designed to use soft coal as their fuel. Linking, as it does, the war-busy centers of Atlanta, Chattanooga, Birmingham and Montgomery with Savannah and the sea, these eight new Limas are materially aiding the Central of Georgia in playing its vitally important part in the war effort of the South.

LIMA LOCOMOTIVE WORKS INCORPORATED

LIMA LOCOMOTIVE WORKS, INCORPORATED, LIMA, O.

Trains

CONTENT — A. C. Kalmbach
PRESENTATION — Linn H. Westcott
COORDINATION — Willard V. Anderson
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THE entire 323-mile Arkansas Division main line of the Missouri Pacific is now operated by signal indication. Centralized traffic control is installed on 126 miles of single track and 39 miles of double track and the balance of the division, all double track, is operated in the normal direction of traffic by automatic block system. Freight locomotives are run over the entire division, which extends from Popular Bluff, Mo., to Texarkana, without change, and with the latest additions to C. T. C. are covering the mileage in three hours less running time. This means that they are ready for return runs that much sooner, and so an appreciable saving has been made in the number of locomotives required to handle the traffic.

Centralized traffic control is a signaling development of the last 15 years which has vastly increased the possibilities of efficient train operation. It is really a long-distance extension of interlocking principles, combined with automatic block signaling, so that all switches and signals at sidings on a long stretch of track are remote-controlled from a central point. On the Union Pacific 171 miles of line is under a single control. Train locations are indicated on a track diagram and instead of slowly issuing train orders by wire for a meeting or passing move the dispatcher watches the progress of the trains in the lights and sets up the meet at the best place simply by moving keys which set the switches and put the proper signals at "take siding," "stop" or "proceed." All this is fully interlocked so that a signal cannot display "proceed" without the proper switch lineups, and without opposing signals indicating "stop." When a switch moves, its new position is electrically confirmed to the C. T. C. machine before signal indications change.

All this is much the same as the lineup of switches and signals in a terminal area by the usual interlocking machine, and indeed that's how C. T. C. started back in 1927 on the MoPac. An experimental section was remotely controlled, but a separate line wire was needed from the machine to each switch and signal group. Such liberal use of copper was all right in small areas, but not along stretches of main line, so a coded system was developed, as now used, by which three line wires serve for all switch and signal control as well as returning the confirming indications to the machine.

The C. T. C. machine partly replaces one of the traditional functions of the dispatcher, the keeping of a train sheet. The machine automatically indicates passing times of trains upon a continuous graph, and the dispatcher merely links up the graph marks so that they form a continuous graphic record of the movement of each train.

Because C. T. C. makes it so much easier for the dispatcher to order meets of trains on short notice, there is less waiting at sidings, and many meets are made nonstop. With C. T. C. a single-track line with proper high-speed sidings can handle from 65 to 80 per cent of double-track capacity. On double track, trains can easily be run in either direction on either track with perfect safety and without the time-consuming precautions of train orders. Thus two tracks can usually handle the traffic of three. *Railway Age* credits Missouri Pacific with the largest track mileage of C. T. C. in the world. It has a total of 561 miles.

Empty Pullman Space

A current survey shows that about 20 per cent of all Pullman space is empty, mostly because of failures to cancel reservations in time so that the space can be resold. If all cancellations were made in time, Pullman could be carrying several hundred thousand more passengers per year. In spite of this, the average occupancy per Pullman car has increased from 10.01 passengers in 1940 to 21.18 passengers in 1943.

As a wartime practice Pullman does not refund fares when reservations are not cancelled in time for resale. This tariff was appealed to the I. C. C. recently by a Chicago businessman and his attorney, who had sleeping-car reservations out of Washington on the *Liberty Limited* which they failed to use or cancel, and on which they were later unable to get refunds. Evidence in the case showed that although every unit of space on the *Liberty* had been sold for the day in question, and although there was a long waiting list, the train left Washington with 57 units of space unoccupied because 57 persons who failed to make the trip at the last minute did not cancel soon enough. The I. C. C. upheld the no-refund procedure and declared it vital for wartime.

New Passenger Cars

The New York Central has placed orders for 300 passenger-train cars, delivery to be made when the W. P. B. releases material for such purpose. Pullman-Standard will build 153, the Budd Company 127, and American Car & Foundry the other 20. Because of materials restrictions no new passenger-train cars have been built since war began, but the NYC order reflects a growing feeling that passenger-car construction will again be possible by the end of the year, although very likely only with provision for future installation of air-conditioning machinery.

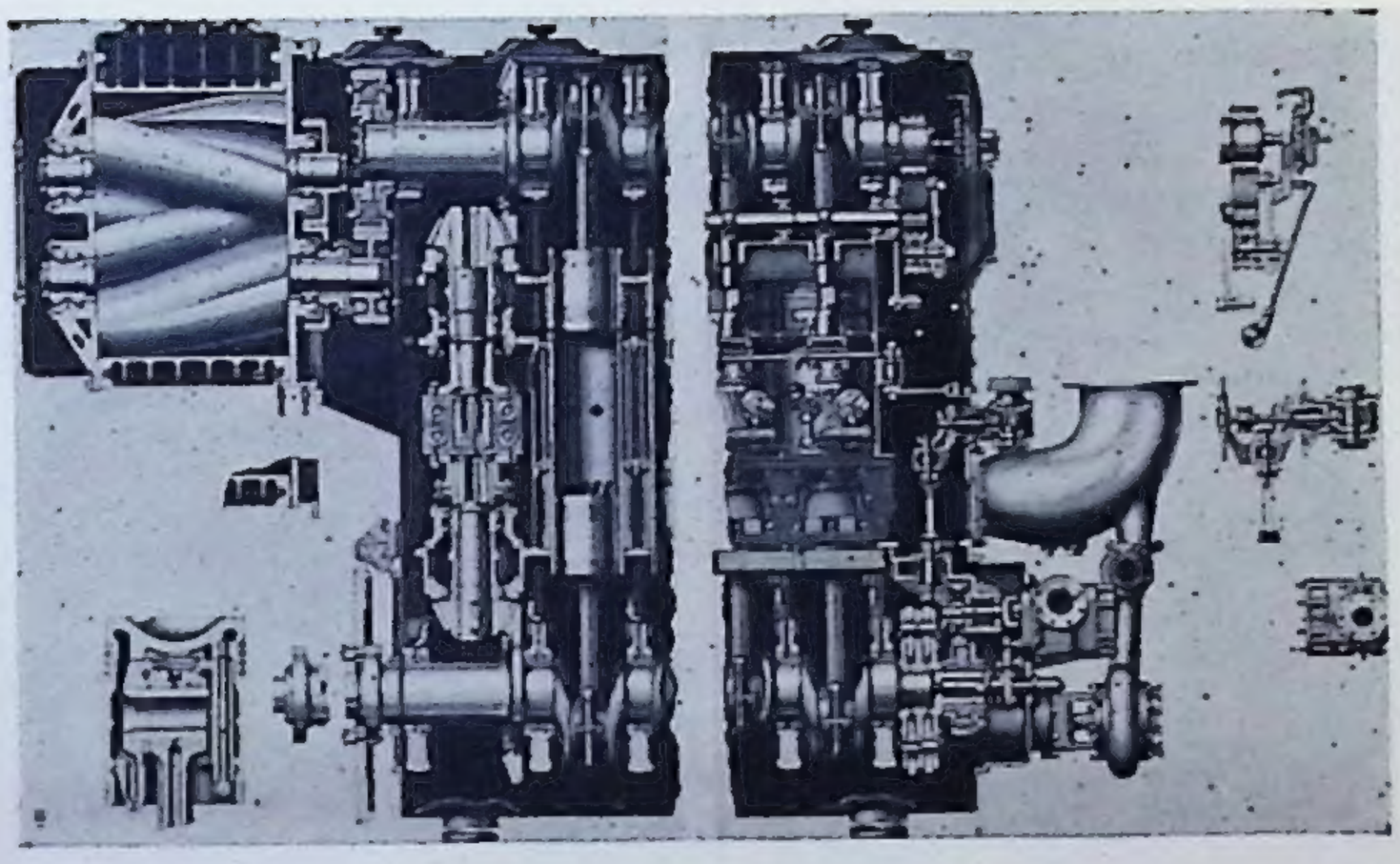
CNJ Coaches Leased

The Santa Fe and the Southern Pacific have leased 40 coaches from the Central of New Jersey. These coaches were released when the O. D. T. ordered 68 trains discontinued from the Jersey City suburban service, so that train crews and motive power would be available for moving war freight. Some 300 trains are still operated by the CNJ in daily suburban service and a questionnaire has recently been distributed to commuting passengers asking suggestions in rearranging the schedules to improve service. These suggestions will be incorporated in a revised timetable to be issued in a month or two.

Fairbanks-Morse Diesels

Fairbanks, Morse & Company has announced its entry in the Diesel-electric locomotive manufacturing field, using its opposed-piston engine which was designed some years ago with locomotive use primarily in view. This engine has no cylinder head. Instead, two pistons are in each cylinder working away from each other to drive crankshafts at top and bottom of the engine (see cut). Because there is no cylinder head, no heat is lost through the cylinder head, and this increases the efficiency, according to F-M, some eight or nine per cent.

Early engines of this type were used in light Diesel trains of the Southern. Later, engines of as large as 2000 horsepower in one unit were developed. But by that time the navy had taken over all production, using the same type of engine for submarines and other naval craft. Locomotive plans were shelved until last month. A complete line of road and switching locomotives will be manufactured and a locomotive erecting shop will be added to the already-huge engine works at Beloit, Wis. The first locomotive under way is for the Milwaukee Road.



Cross-section of the Fairbanks-Morse opposed-piston Diesel, which has no cylinder head and no valves, the pistons uncovering exhaust and air-inlet ports at the end of stroke. This type of engine will be used in the new line of Diesel locomotives announced by F-M.

Locomotive Notes

The New York Central has ordered an experimental 4-8-4 steam locomotive from American Locomotive Company. . . . The C&O is inquiring for six 4-6-4 locomotives. . . . Baltimore & Ohio has nine new passenger Diesels on order with delivery expected about the end of the year. All B&O Diesels will then be pooled in through mainline service, using New York-Washington runs to fill out otherwise idle time on the eastern end. All servicing will be done at Washington. . . . In its new L-4 Mohawk-type locomotives the NYC has power capable of pulling post-war fast freight trains between Chicago and New York on the present *Twentieth Century* schedule, should such service be commercially desirable and feasible. . . . The Bangor & Aroostook has ordered a 2-8-0 and a 4-8-2 from American Locomotive. . . . Richmond, Fredericksburg & Potomac has ordered 10 4-8-4's from Baldwin. . . . The New Haven has ordered 42 Diesel-electrics, including 20 2000-horsepower dual-service road locomotives, 12 1000-horsepower switchers and 10 44-ton switchers, the last from General Electric and the others from Alco. . . . The RF&P now has five N&W K-2 Mountain type locomotives.

Gas-Turbine Locomotives

The Allis-Chalmers Manufacturing Company, West Allis, Wis., has designed a gas-turbine locomotive which it will produce as soon as materials are available. This will be a mainline motive-power unit of high horsepower. General Electric has also made gas-turbine studies and has designed a 4500-horsepower unit which is only 75 feet long, with an estimated weight of 180 tons. The gas turbine, which has already been experimentally used on a Swiss locomotive, operates on the principle of burning the fuel and converting the expanding products of combustion directly into rotary motion in a turbine. For locomotive purposes this turbine drives through an electrical transmission the same as does the Diesel-electric. The principal problem is metallurgical, since the thin turbine fins must stand the extremely high temperatures of combustion. The gas turbine is comparatively flexible in its fuel requirements.

A. C. Kalmbach.

June, 1944 **Volume 4 Number 8**

NYC West Side Freight Line. A photo story. - - - 6
Haunted Roundhouse. By W. T. Coniff. - - - - 12
Recent 4-8-4's. Specifications. - - - - - 16
Water Holes for Iron Horses. From L&N Magazine. - - 18
The Man in the Tower. By Edward Hungerford. - - - 22
D&RGW in Eagle River Canyon. A photo feature. - - 25
Uruapan Express. By Neill James. - - - - 26
Two Early Trains. Old-time photos. - - - - 31
Great Britain's Garratt Locomotives. By O. S. Nock. - - 32
Women Railroaders - - - - - - - 42

Cover photo by Richard H. Cobb Jr.

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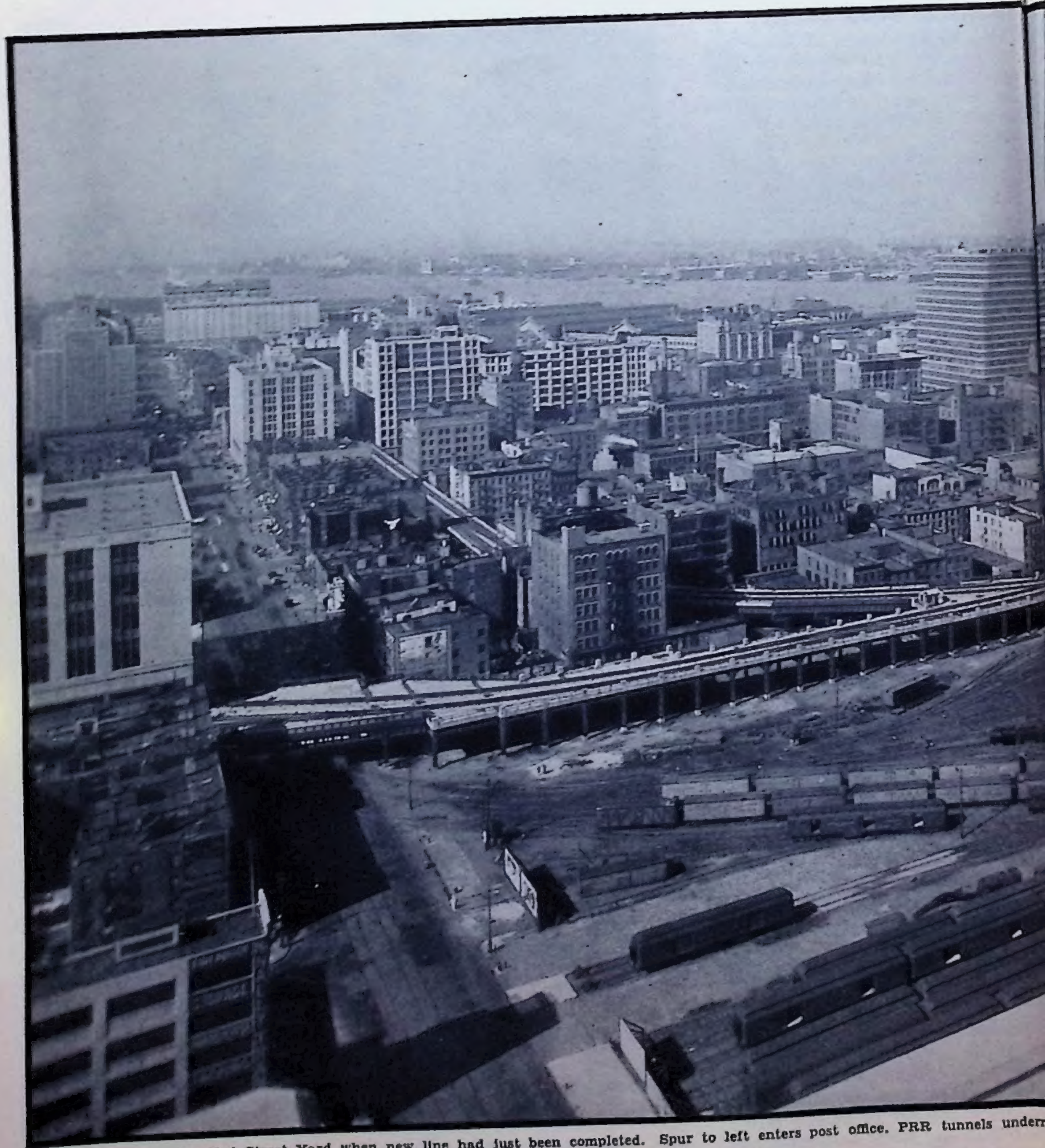
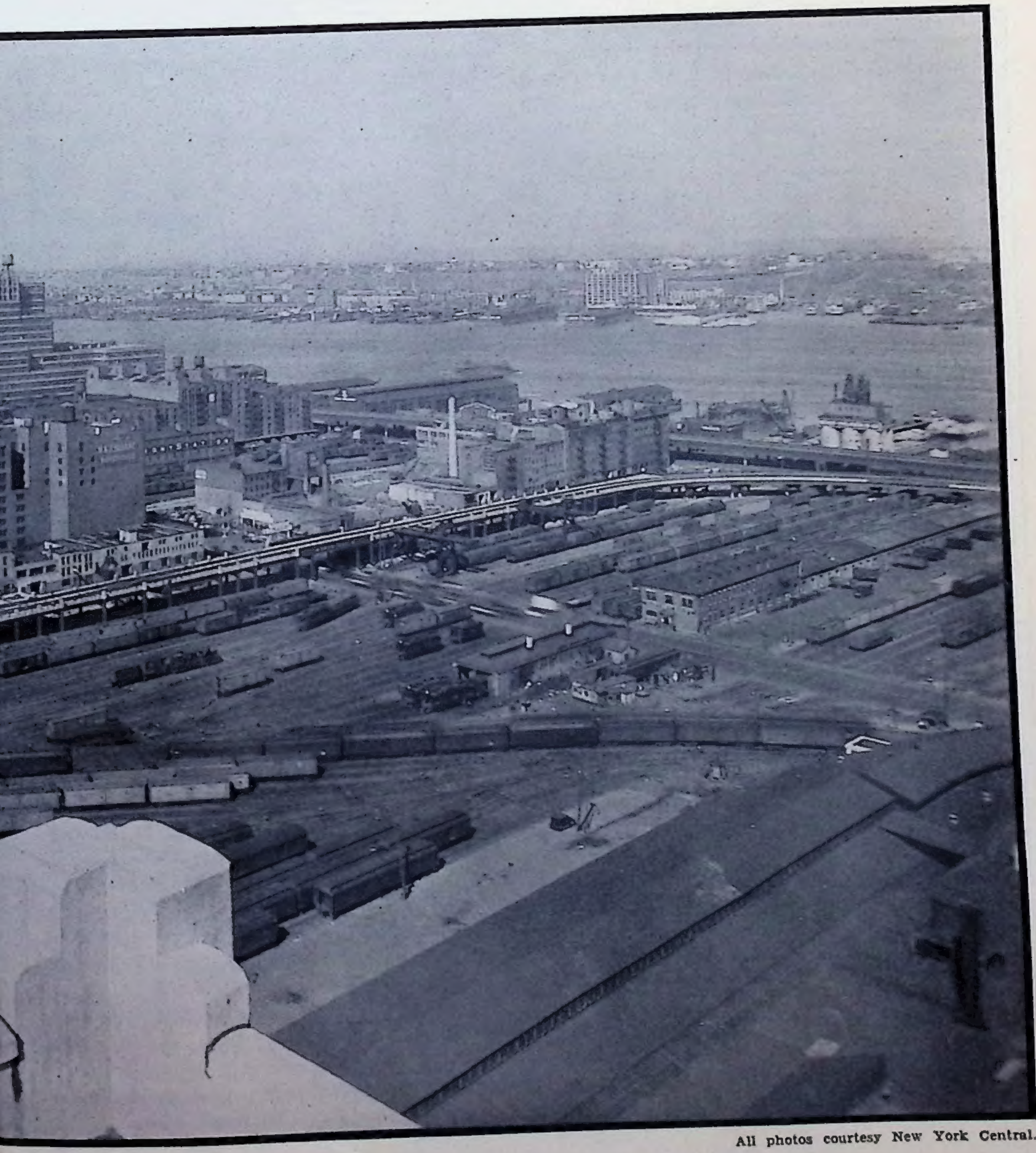


Looking south over the 33rd Street Yard when new line had just been completed. Spur to left enters post office. PRR tunnels under

NYC West Side Freight Line

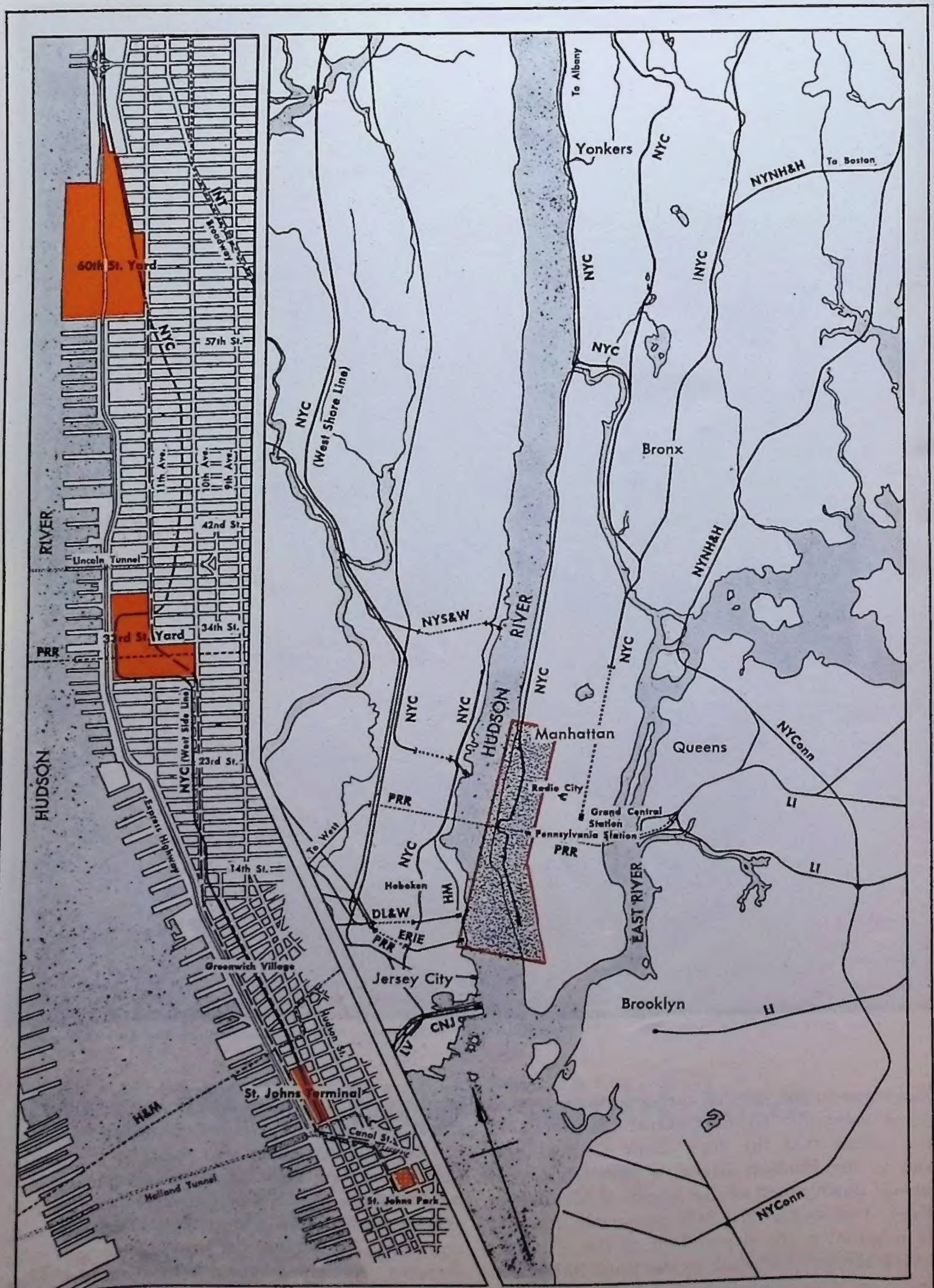
Only all-rail freight route into Manhattan has been completely modernized within last decade.

A PHOTO STORY.



All photos courtesy New York Central.

PASSENGERS in the plushy, air-conditioned comfort of trains into Grand Central Terminal seldom realize that the New York Central has, close to the Hudson River, a parallel line of railroad down much of the length of Manhattan Island. Just as the East Side passenger line into the terminal is the descendant of the old New York & Harlem Railroad, so the West Side Line, now given over entirely to freight, express, and parcel post, is the descendant of the old Hudson River Railroad. When Commodore Vanderbilt consolidated these two roads as the beginning of the New York Central System he created by the same stroke the two-pronged terminal system which now serves New York so well, separating completely the passenger and freight services. Not since World War I has the West Side Line carried regular passenger service.



Linn H. Westcott.

In the late 1930's a vast improvement program was brought to completion which took West Side freight trains off city streets, put them behind electric power north of 30th Street and behind Diesel power south of 30th Street, and brought them into an immense new freight station at the south end of the line.

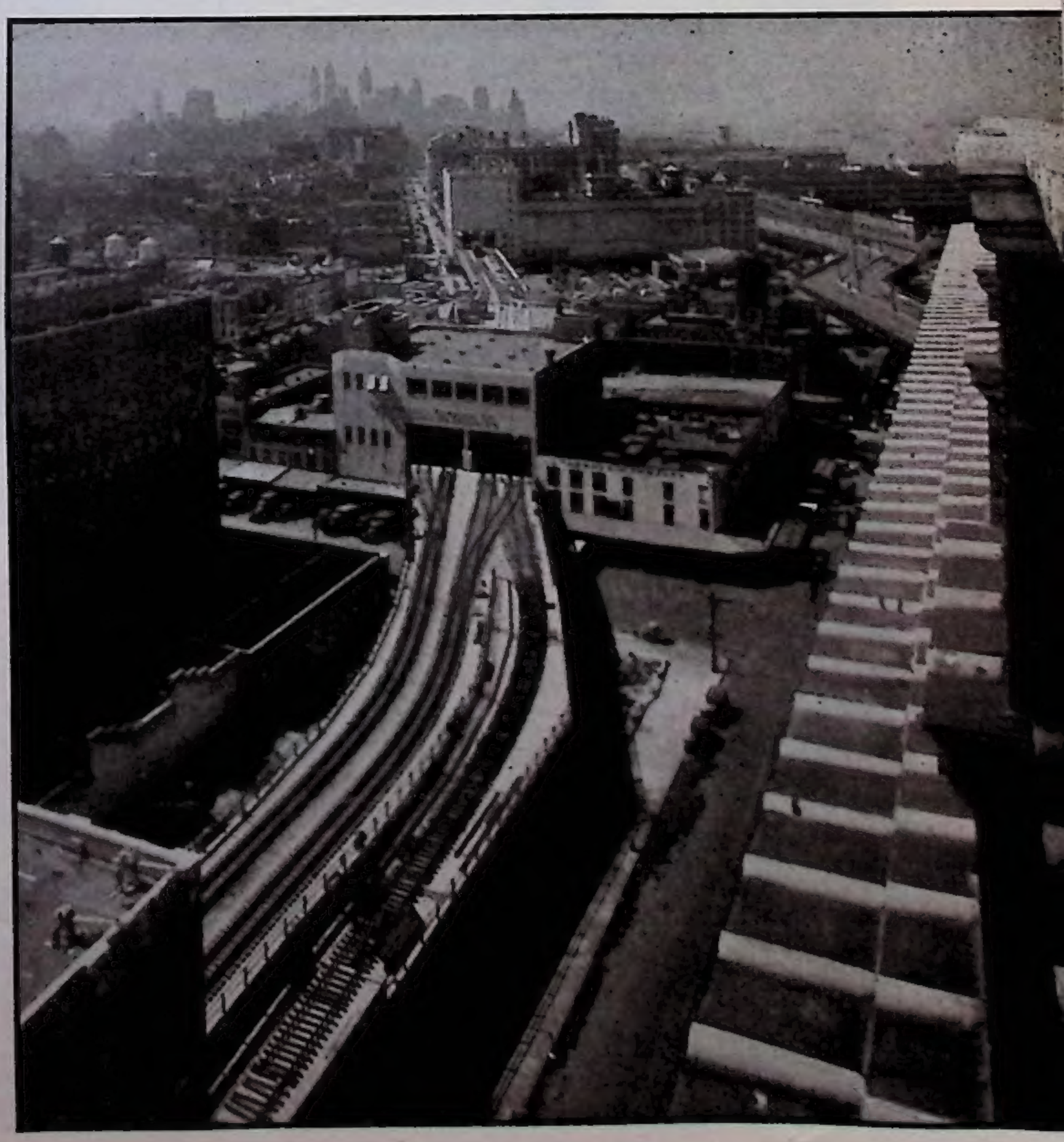
Below 60th Street, where the NYC has a large freight yard next to the river, West Side tracks formerly ran in city streets and each train was preceded at six miles an hour by a cowboy on horseback who waved a red flag to warn motorists. Now the tracks from 60th Street to 30th Street are in a cut and from 30th Street to St. John's Park freight terminal they are elevated, passing right through a number of industrial and warehouse buildings and thus furnishing ideal enclosed siding facilities.

At 30th Street, on the site of the one-time Hudson River Railroad passenger station, is the Morgan Parcel Post Building, where the NYC loads mail cars for all principal points on the NYC as well as for many cities west of Chicago. The biggest train made up here is No. 159, the *Chicago Express*, which includes eight or nine cars from the parcel post building. Cars are consolidated with those from the West Side Railway Express Building at 32nd Street before running as a train up the West Side Line to Harmon, where they are joined to the portion of the train from Grand Central.

The St. John's Park freight terminal replaced an older structure of the same name farther downtown. The old terminal was built in 1868 on a tract of park land sold to the railroad by St. John's Episcopal Church, which is how a freight station acquired such an unusual name. The old building was magnificent in its day, a prime accomplishment of Commodore Vanderbilt. The new St. John's, opened in 1934, is one of the largest freight stations in the country and handles freight in both carload and less-than-carload quantities. For more than half a century St. John's Park has been New York's principal delivery station for dairy freight, including butter, eggs, cheese and dressed poultry.

The freight yards at both 33rd Street and 60th Street are so planned that the space can later be built up through lease of air rights, much as was done in the Grand Central district. For some 2½ miles above 79th Street, Riverside Park has been extended over the tracks on a framework of steel, adding 32 acres to New York's park area.

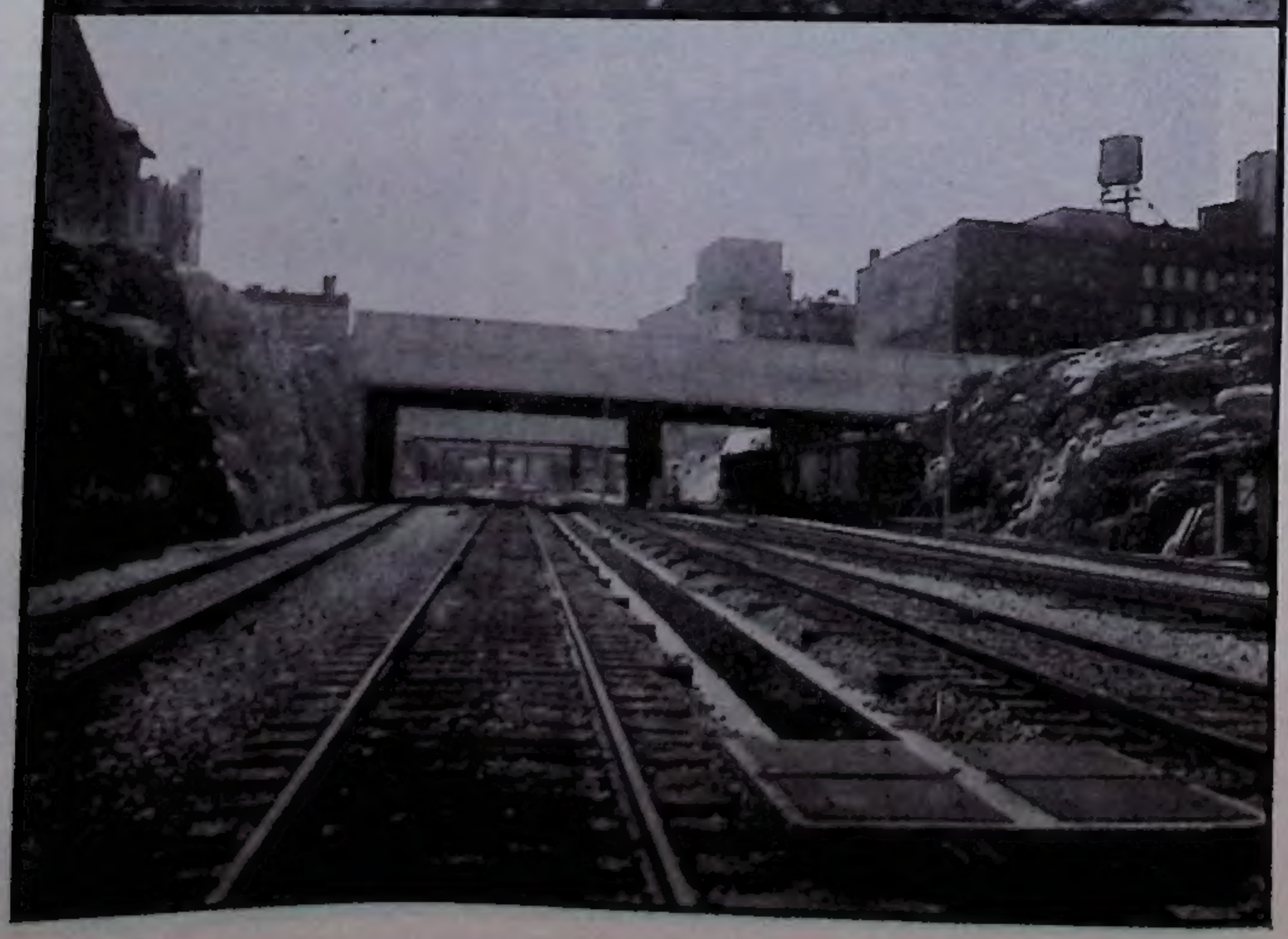
An elevated section of the New York Central's West Side freight line, looking south from West 14th. The Hudson River and the elevated express motorway are to the right. At end of track in the distance is St. John's Park freight station.



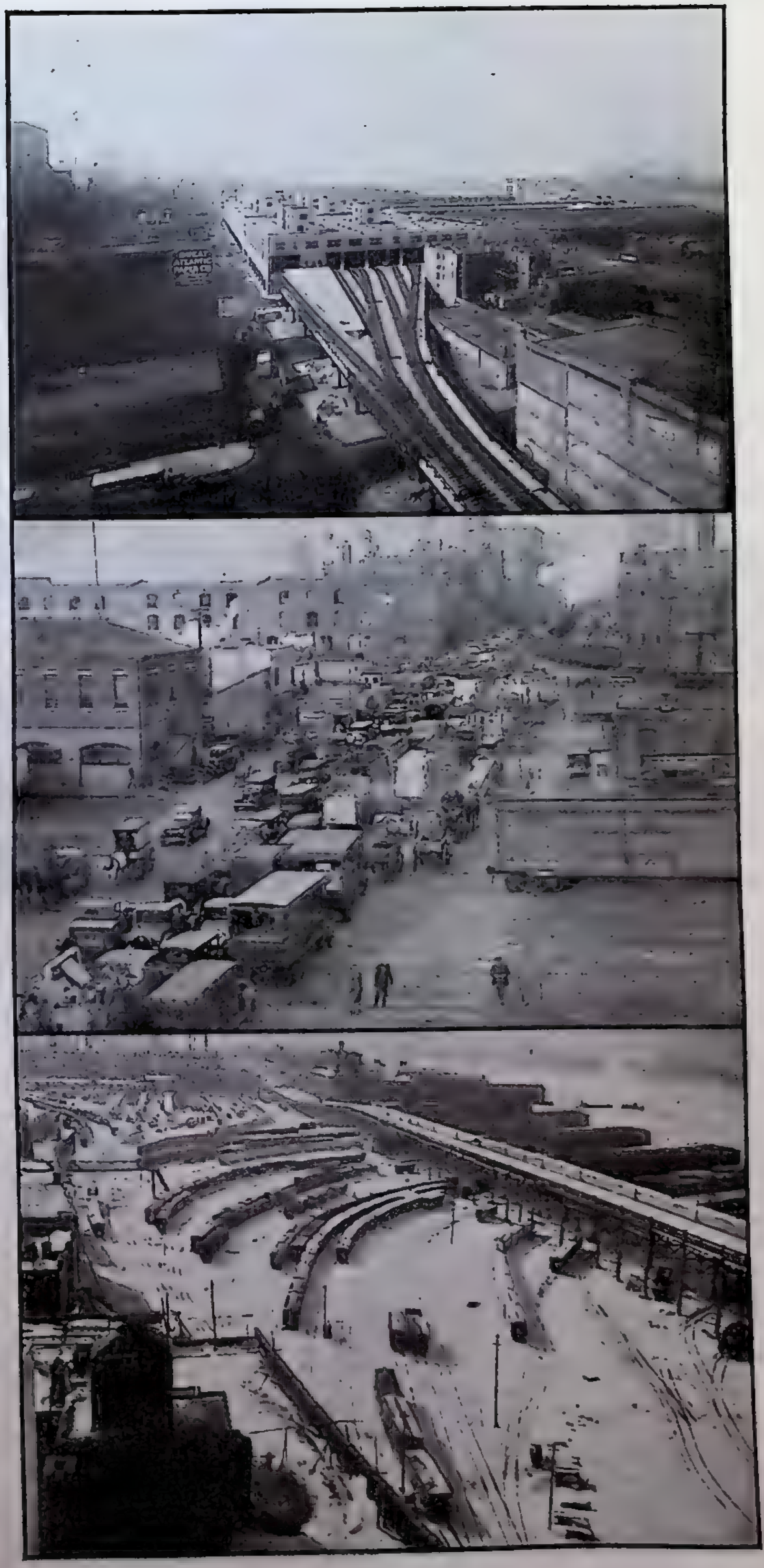
The lower end of the NYC's West Side freight line in New York City is shown in detail in the left-hand map. Dotted lines are the old route in city streets, solid lines the present-day railroad. The other map fits the detail into the New York area.

From 1868 to 1934 the New York Central's principal downtown freight station was old St. John's Park, left, at the end of the one-time Hudson River Railroad, now the West Side freight line. A feature of the west front of this building was a huge bronze statue of Commodore Vanderbilt which was moved in 1929 to the front of Grand Central Terminal, where it faces down lower Park Avenue.

Excavation in progress for improvement of the NYC's 33rd Street freight yard, which was lowered below street level as part of the West Side program of the middle 1930's. The building in background was underpinned to suit the new track layout, and a new elevator shaft was extended down to track level. The main line for West Side freight was, up to the time this photo was taken, down 11th Avenue, the street across the middle of the picture.



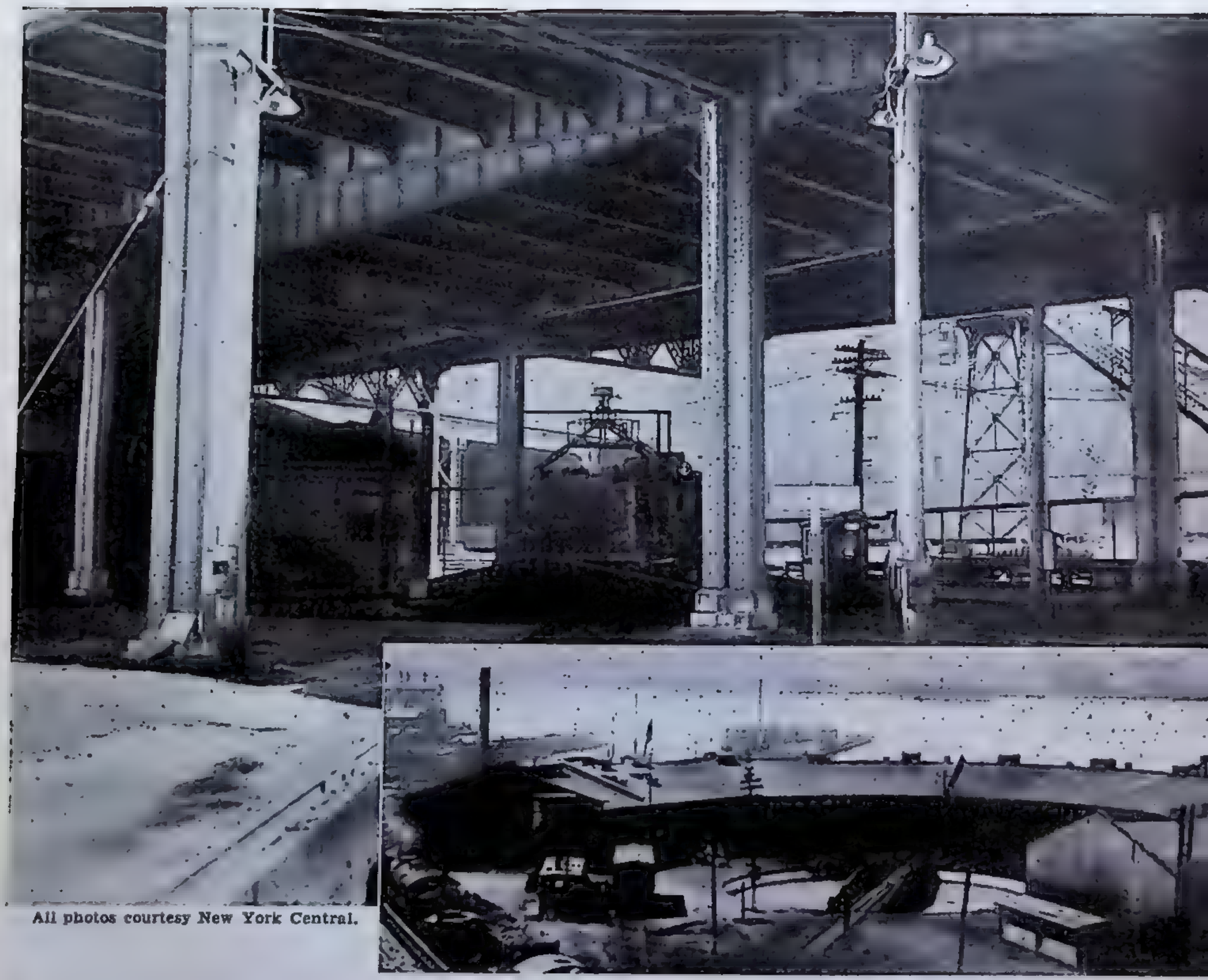
Much of the West Side freight line is in an open cut blasted out of the granite backbone of Manhattan. This view was taken at the throat north of the 33rd Street yards, where the track layout is used for extensive switching. Notice the longer ties for third rail, which was not installed at the time.



The present St. John's Park freight terminal is a three-story building, three blocks long by one block wide. The street floor is the freight house proper and has back-up platform space for 127 trucks inside the building. The second floor is the track floor and has eight tracks in pits with concrete track floor construction to facilitate cleaning.

The old crossing of 11th Avenue through the 33rd Street NYC yards was typical of the traffic problems which the road now avoids by the improvements on the West Side Line. The freight train running down the middle of the street in the background is on the old main line. Both yards and main line are now below street level at this point.

Largest and most important freight yards on Manhattan Island is at 60th Street. It provides not only freight terminal facilities but rail-water facilities as well. The main tracks of the West Side freight line are close behind the buildings in the lower left corner of the photo. The main line past here is operated by electric locomotives taking power from a third rail, but yard switching is by Diesel-electrics.



All photos courtesy New York Central.

Haunted Roundhouse

Hidden beneath New York City's Express Highway, Hudson River roundhouse is memory of the past.

BY W. T. CONIFF.

THERE is a haunted house at the foot of West 72nd Street in New York. Well, it is not exactly 72nd Street, for since the completion of the Express Highway, the bridge high above the maze of tracks that the railroaders call "The Farm" is at the foot of 71st Street. There, crouched under the towering structure of the elevated highway, is the old Hudson River roundhouse, and it is haunted by the wraiths of the iron horse of steel and steam that vanished from New York's West Side with the electrification of the New York Central's freight and terminal operations in the city.

It is a far cry since the boom days of the '20's, when the 72nd Street Yards hummed with business and half a hundred steam yard-engines called it home. Now, spluttering Diesel-electrics that look like misshapen black beetles haunt the crumbling stalls where only a few years ago the last of that sturdy stable of steam yard-goats and powerful, businesslike freight-haulers were quartered. A gap in the circular walls separates the old roundhouse into two segments facing each other across the turntable pit. The old tracks extend out into the vacant space and open pits yawn like un-

covered tiger traps beneath the massive columns that straddle the huddle of old buildings and shelter it in part from the rains and snows of the changing seasons. Only a few of the stalls are utilized now; Diesels spend little time in the roundhouse. A relief crew brings them in, two by two like animals into the ark, across the bridge-like turntable for the brief inspection and servicing that they receive each 24 hours.

Gone is the cinder pit with half-naked fire-cleaners shaking cascades of glowing coals down through the pans of incoming engines. No whistles moan at the coal chute where impatient hostlers jockeyed steam engines back and forth for "smokeless coal" and the "sneezo" that was regular fare for the road engines. The coal chute has vanished with the water plug in the wholesale renovation that accompanied the change in motive power.

Of the once sizable shop force, few remain. About five men on each shift inspect and service the Diesel-electric yard engines and the straight electrics that haul freight trains into the city from Harmon, northern terminus of the electrified section, 33 miles away. You can hear the shop force about its work when engine bells ring without apparent reason and air brakes apply and release, as engines are tested on the storage tracks in the Basin Yard under the echoing vault of the great girders that carry the landscaped park area and highway above the railroad tracks for several miles north of 72nd Street.

At the southern end of the semicircular house is the engine dispatcher's office and foreman's headquarters. On the call-board that covers most of one wall in the dispatcher's office are the designations of all engine crews working in freight or yard service between New York and Harmon, and the through trains that are manned from this terminal. Tags bearing the names of each engineer and fireman are hung on their various assignments. The initiated can spot vacancies and predict, with some degree of accuracy, the number of men that will be used as long as 12 hours in advance. Down the center of the board is the extra-list, the men on which are subject to call at any time. They are the shock troops of the railroad and give the service elasticity to absorb the unexpected influxes of traffic, floods, wrecks, or any other contingency that may arise.

Twenty-four hours a day the two telephones keep up an incessant and insistent clamor. The dispatcher, sometimes talking into the two instruments and carrying on a conversation with someone in the outer office at the same time, jots down notes of projected movements, calls men for various assignments for points as far north as Hudson and Poughkeepsie and from all the towns along the division. He notes the arrival and departure of engine crews and makes corresponding changes on the board. Men call in to "mark off" or to "mark up," and supervisory officials make brusque requests for information on train delays.

Engineers and firemen are continually coming and going through the narrow doorway of the outer office, exchanging rough jibes with the harassed dispatcher, glancing through the sheaf of ever-changing bulletins and notices that must be acknowledged before each trip. A yellow register-slip must be signed when going on or off duty, and departing engine crews must compare their watches with a standard clock. Notices of brotherhood meetings and obituary announcements are tacked near the bulletin board. Through the foggy glass of the windows one can see the full flow of America's war effort bound for the far-flung battlefronts of the world.

The float job, with its string of battered old flat cars that enables it to reach across the float or pontoon to the busy float bridges without putting the locomotive's weight on the pile-supported approaches of those structures, unloads the tethered car-floats which perform so much of the interchange work for railroads in the metropolitan area. The slow, careful Diesel worries the cars off, first on one side and then on the other, trimming the weight carefully before doubling onto the center track of the clumsy, cranky, blunt-bowed craft and pulling

the 24-car draft up into the yard where it is swiftly batted out or shoved onto the hat track for the hump engine's attention. Another engine grinds by with a long string of flat cars loaded with army-colored tanks, squat and grim; crated Spitfires are bound for the open pier where floating cranes transfer the tanks and trucks and planes to lighters that will carry them to shipside. The running gear of an electric locomotive of meter gauge is bound for South America, and here, on an inbound draft, is a drop-end gondola with huge mahogany logs, hewed square as they hew them only in British Honduras.

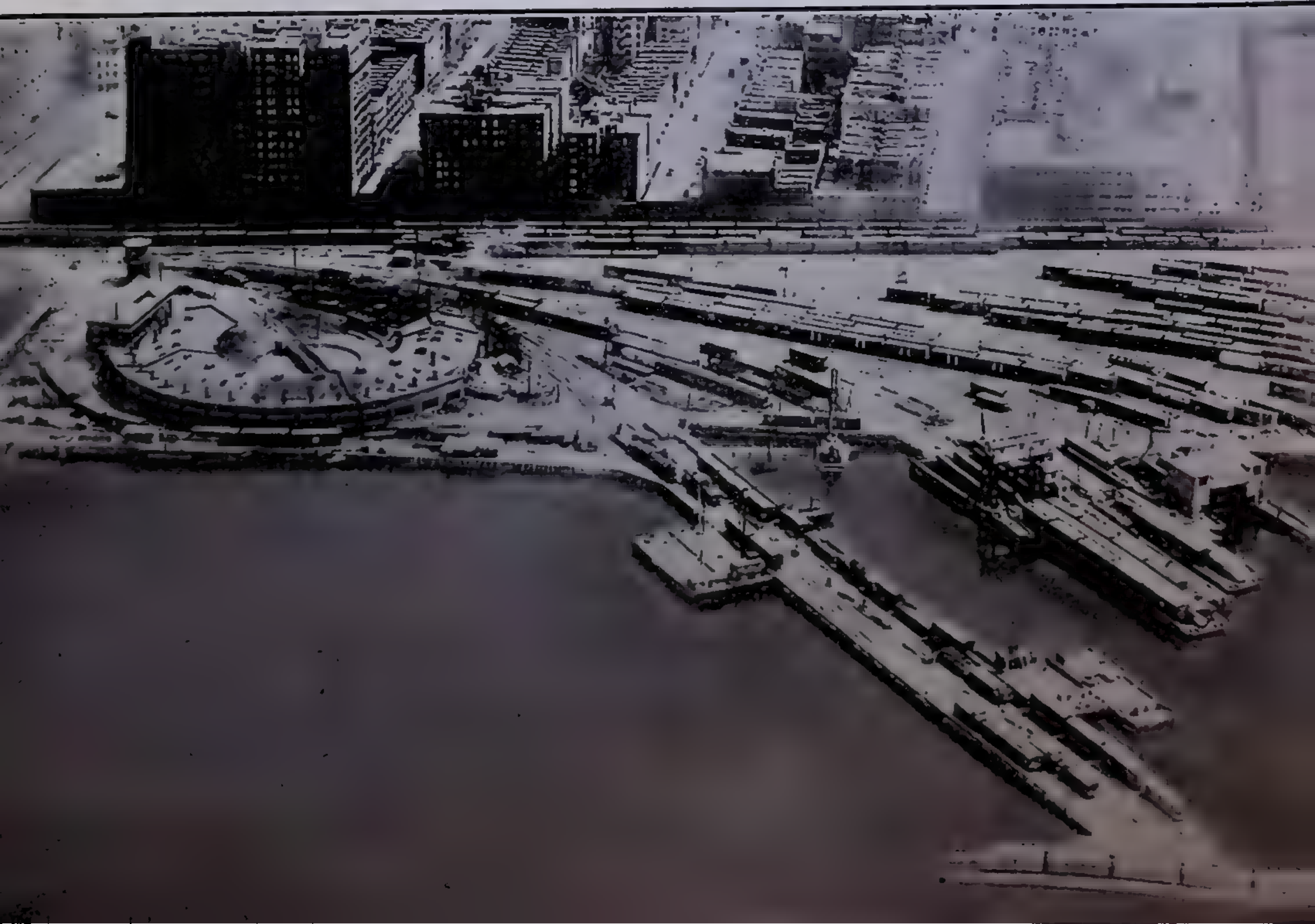
"A great gang used to work here in the old days," said one of the laborers in the roundhouse. "I've seen 20 engines lined up at the cinder pit waiting to have their fires cleaned. When times were good they couldn't get enough men. There were all kinds of emigrants in here at different times—Irish and Italians and Poles and Finns, right off the boat, willing enough but gullible and green. I remember one big Italian firecleaner, an enormous fellow, strong as a bull.

"They used to send yard engines in then to have their fires cleaned while the crews went to supper. One of the firemen had an idea that by a little strategy he could stretch their 20-minute lunch period to a longer period." The old fellow chuckled to himself and continued. "Well, just before they brought the engine in the fireman shook his fire down until the grates were barely covered. He had noticed that the big Italian was in the habit of shaking the fire thoroughly before looking into the fire box. They put the engine on the pit and scrambled off as the fire-cleaner climbed on and pulled the shaker bar off the tank. 'Give 'im a shake, Tony,' the fire boy said on his way out the gangway. Already the big fellow had the shaker bar on the grate levers and was swaying back and forth for dear life. He went across the row, front section, middle and back, and then he stepped back, pressed the door pedal and bent down to look in at the empty firebox.

"Well, sir," the old fellow went on, "the fireman had his long supper hour. They had to build up a fire with wood and it took almost an hour to get the engine ready to go out again, but the big fire-cleaner never heard the last of that 'Give 'im a shake, Tony' as long as he was here."

Outside on the "ready" track two "R" engines, coupled in multiple with heavy cables looped between them, awaited a crew. "Look at 'em now," an old-timer in the shop force said.

Before electrification.

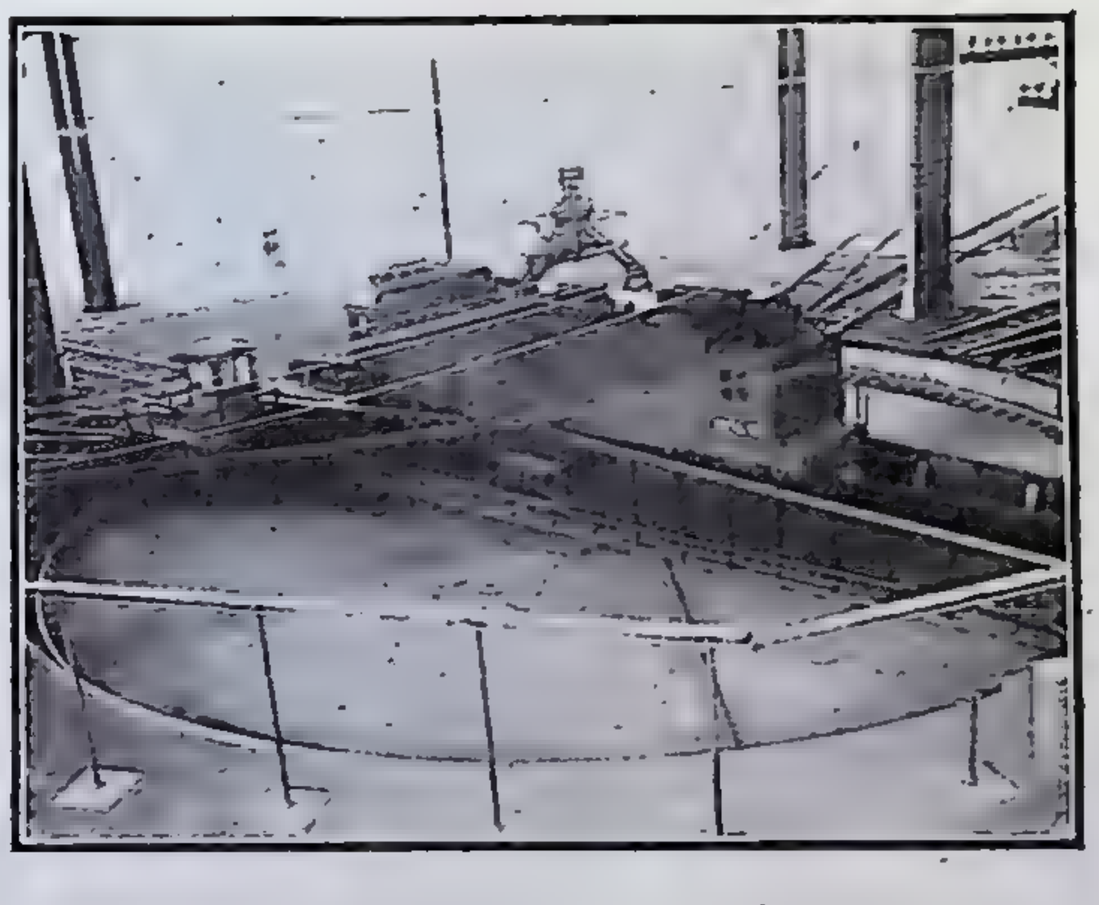


"There is no difference in any of them. They will pull so much, not a pound more; they will run so fast, not a mile faster if you were falling down a well with them. Perhaps they are an improvement over the steam engines here in the city, but they have their shortcomings too. For one thing, they are dirty; the old steam engines were scalded and scoured and wiped and polished once in a while anyway; but these things aren't even swept out except once in a blue moon. You can't wet them down or wash them, for they have no water; and if you did you'd be apt to get electrocuted. Those big traction blowers that keep the motors cool blow a fine grit into everything and through everything. In the winter that dry searing heat will burn your legs off while your back is freezing and the frost is forming on the rivet heads of the cab, and you have to keep the window open a little no matter how cold it is or you are apt to drowse for a minute and miss a signal or wake up with somebody's caboose in your lap." He shook his head and wandered off toward the locker room.

Behind the office, in a long bare room, the stationary engine runs almost without noise. A muffled exhaust beside the flaring mouth of the black stack trails a ribbon of steam high in the gloomy recesses where birds seek shelter from the cool breezes off the river. Next, the long sand-track leads directly through the roundhouse to the racks where the sand boxes of the Diesels are refilled each time they come in for servicing.

Outside, under the arch of the viaduct, a heater car or "kitchenette" is spotted at the hoses to receive fuel and water. In each of these units, of which there are five, a vertical, oil-burning boiler carrying a steam pressure of 200 pounds per square inch is used to supply heat on mail and express merchandise trains hauled by R-type locomotives. These engines, designed for freight service, are not equipped with heating boilers, as are the S and T types of passenger locomotives. Even in the summer, kitchenettes are used when shipments of live fish consigned to the New York market require that the water be heated for their finny passengers.

It is gloomy under the shadow of the Express Highway. Water drips monotonously down from the clammy condensation on the towering girders. A little to the north the general yard office is the pulsating heart of the battle to keep them rolling—the office that integrates the ebb and flow of wartime traffic into an orderly pattern



and translates it into terms of trains and men. Behind it, toward the river, is the Railroad Y. M. C. A., or as it is more commonly called, "The Lord's Barn," where men eat and sleep between trips.

Across the shallow turntable pit in one of the dingy stalls of the old roundhouse is a test rack for the Diesels. Heavy cables snake across the floor and an imposing array of gauges and meters are banked above the elevated platform that runs for an engine-length beside the old pit. Here, under the searching eyes of vigilant inspectors, the ills and ailments of the new motive power are diagnosed and corrected. A monthly report, sworn to before a notary public and similar in many respects to that required by the Interstate Commerce Commission for steam locomotives, is encased in glass in each cab, as symbolic of virtue and integrity as a framed marriage license in a New England home.

Diesel-electrics and other types of electric motive power now in use on the New York Central's Electric Division require no turntable. Equipped to operate from either end, they run in either direction by changing the controls. The slow attrition of the years made little impression on the stoutly built old roundhouse, but one by one the changes in motive power have stripped it of its functions until it has been virtually eliminated as a factor in the maintenance and repair of the present equipment. The long, cavernous tunnel under the highway and park area may well turn out to be the successor to the picturesque old ruin of the once-busy engine terminal; but whatever happens to the old Hudson River roundhouse, the gallant ghosts of the vanished steam engines will haunt the spot forever and a day.

Recent 4-8-4's

LAST fall new orders of 4-8-4 type locomotives were delivered among others to the Canadian National, Lehigh Valley, and Nashville, Chattanooga & St. Louis. All of these were similar to earlier locomotives of these roads, and demonstrated the success of the 4-8-4 wheel arrangement in meeting modern traffic conditions.

The NC&StL engines are a stripped version of a semi-streamlined job, all mechanically unnecessary metal parts having been removed from the wartime design. The Lehigh and NC&StL engines were built by Alco, the Canadian National by Montreal Locomotive Works.

Specifications:

	CN	LH	NC&StL
Road classification	U-2h	T-2b	J-3
Road numbers	6235-6264	5211-5220	580-589
Tractive effort, pounds	56,800	66,700*	57,000
Cylinder diameter and stroke, inches	25½ x 30	26 x 32	25 x 30
Driver diameter, inches	73	70	70
Weight on drivers, pounds	246,100	274,500	228,000
Weight of engine, pounds	400,300	451,000	399,000
Weight of tender, pounds	278,150	304,400	234,700
Steam pressure, pounds	250	255	250
Grate area, square feet	84.3	88.3	77.3
Evaporative heating surface, sq. ft.	4080	5376	4203
Tender Capacity: Water	11,600†	20,000	15,000
Tons of coal	18	30	16

* With booster, 70,000 pounds. † Imperial gallons.

Santa Fe 4-8-4's

THE heavy end of Santa Fe steam locomotive work is handled by 45 4-8-4 type engines, 10 of which were new this last winter. These are numbered in the 2900 series and are similar to the next earlier batch, 10 built in 1941 and numbered from 3776 through 3785. The still earlier 4-8-4's are numbered from 3751 through 3775.

The new locomotives, 2900 class, are assigned to through freight runs between Argentine, Kan., and Clovis, N. Mex. The 3776-series engines are used on some long passenger runs, the longest on trains 3 and 4, the *California Limited,* between Kansas City and Los Angeles via Topeka, 1791 miles.

Comparison of the specifications for the 1941 3776's and the 1944 2900's shows them to be identical except for total locomotive and tender weights. Due to wartime demands for conservation of critical materials, the boilers, frames and connecting rods of the new locomotives are made of plain carbon steel instead of alloy steel as used in the 3776's, and this made an engine of greater weight. A change in design of crosshead was also made for the same reason.

Santa Fe locomotives of recent years are distinguished principally by their impressively bulky appearance. The box-car-huge tenders contribute to this in no small measure, although the engines themselves really are big, with over-all dimensions nearly a foot wider and higher than many Eastern locomotives.

All of the Santa Fe's 4-8-4's have been built by Baldwin.

Specifications:

	3776	2900
Series		
Road numbers	3776-3785	2900-2909
Date built	1941	1944
Tractive effort, lbs.	66,000	66,000
Cylinder diam., stroke, in.	28 x 32	28 x 32
Driver diameter, in.	80	80
Weight on drivers, lbs.	281,900	295,000
Weight on pilot truck, lbs.	93,320	94,300
Weight on trailing truck, lbs.	119,410	121,400
Weight of engine, lbs.	494,630	510,700
Weight of engine, tender, lbs.	960,630	975,400
Steam pressure, lbs.	300	300
Grate area, square ft.	108	108
Evaporative heating surface	5311	5311
Tender Capacity:		
Gallons of water	25,000	25,000
Gallons of oil	7,000	7,000

Water Holes for Iron Horses*

More is involved in supplying the railroad with water than merely turning on the faucet.

WATER, like life, liberty and the pursuit of happiness, is something the great American public takes for granted, with an occasional reminder from the local water company that it is not quite as free as air. This is correspondingly true even of the average railroader, who may be likely to feel, in his more unthinking moments, that a railroad has solved its water problems when it has assured itself of a plentiful supply of *aqua pura* for the coolers in the day coaches. Such a concept obviously has no relation to reality; in fact, water is a peer of coal, wood, and steel, for water makes steam and steam makes the wheels go!

The Louisville & Nashville alone used nearly three million tons of coal in 1940 for converting water into steam and for other purposes. This would make a sizable fire in anyone's furnace. However, the road's parallel use of over seven billion gallons of water would have been amply sufficient to have quenched this blaze. Seven billion gallons is obviously a lot of water, and its procuring, storing, treating and subsequent supplying to locomotives and shops and various other thirsty facilities is just about one of the biggest jobs the railroad has. In fact, of the thousands of commodities which the railroad uses annually, water not only weighs the most in the aggregate, but is the greatest in volume as well, it being estimated that the water used annually on this one railroad alone would form a lake one mile square and about 35 feet deep.

Seeking the exact low-down on water supply, I journeyed to the chief engineer's office in the general office building of the L&N at Louisville, where K. P. Howe, assistant engineer, gave a number of revealing statistics. Water, we know, is sometimes referred to as H_2O or *aqua pura*. The reference is generally made somewhat facetiously, and rightly so, if the glimpse I caught of marine life in a drop of water under the microscope was not a figment of my imagination. Water in an ideal state may deserve the appellation "H_2O" and it may then be *aqua pura* all right, but ordinary run-of-the-mill water, such as you or I might encounter in any rill or brooklet in our neighborhood, has a number of other ingredients whose presence in excess can play hob with the efficiency of a locomotive.

The old-time railroaders, with their lamentable tendency to oversimplification, gave scant attention to the quality of the water which they dumped into the tanks of their locomotives. In fact, it is said that, prior to the turn of the century, fish and other forms of marine life often found their way into the water tanks and subsequently into the tender tanks of locomotives. Today, however, the proper treatment of water is a prime consideration. Much money is spent annually for chemicals and for water-treating installations which will remove harmful ingredients.

The L&N stores its water in huge tanks. Generally, these tanks have a capacity of 63,600

* Adapted from an article by Kincaid Kerr in *L&N Magazine*.

Southern Pacific oddity.

One of the strangest listings of railroad officers in the *Official Guide* appears under the Southern Pacific section. The huge SP—stretching from New Orleans to Portland, and covering the Pacific Coast—has headquarters in San Francisco, with a general office in New York, and a large office in Chicago. Heading the list of general officers is A. T. Mercier, president, San Francisco. Then follows the usual list of vice-presidents in charge of operations, traffic, general counsel, etc. The thirteenth name in this list is the oddity. It is J. M. McCreight, assistant clerk, Spring Station, Ky. The closest the SP comes to Spring Station is New Orleans. Why, then, a general officer at such an out-of-the-way place? Inquiry showed the Southern Pacific is incorporated under the laws of the State of Kentucky. As such a corporation, it must maintain some official in the state. So McCreight is given the title. The pay-off is that while he is a general officer of the Southern Pacific, McCreight's regular position is on the Louisville & Nashville.—*Henry D. Rennwald.*

Taking water at the 10th Street Yards of the L&N at Louisville, Ky.

Courtesy Louisville & Nashville.

gallons of water and are of creosoted pine construction. The tank proper is 24 feet in diameter and 18 feet 9 inches deep, and rests upon a timber framework which is 22½ feet high. On the southern end of the system, where freezing is a factor that can be disregarded, the tanks are frequently not covered, evaporation and rainfall just about balancing each other. Tanks formerly were smaller; a few of 50,000-gallon and 20,000-gallon capacity still linger in the service. The L&N also has a few behemoth tanks at points such as DeCoursey, Boyles, and Howell. These are of steel construction and have capacities ranging from 100,000 to 200,000 gallons. A shop such as DeCoursey or Boyles will use nearly a million gallons of water a day and think nothing of it.

In all, the L&N has 280 water stations along its line and at its various shops. These function as "middlemen" between the engine tenders, etc., and the sources of supply, and the water is pumped into them by a variety of methods. Ninety-nine of the stations receive their supplies from outside sources; in such cases the water is kept at a certain level in the tank by pressure and by a float arrangement. One hundred and nineteen of the stations have their water pumped to them by steam-operated pumps, two by oil-operated pumps, one by a hydraulic ram, 22 by electric pumps and 37 by gravity. The present trend in water-station pumping facilities is toward electrification, for this type of pumping station costs less to operate and works automatically.

Generally speaking, the water tank is the key structure in a group of facilities which function to supply suitable water to locomotive boilers. The water is removed from the source by huge intake pipes which are screened to keep out "undesirables," as, indeed, are the tanks on the locomotives. The source may be a company-owned lake, or it may be a river, creek, well, pond or spring.

The water is pumped rapidly and in enormous volume, some of the pumping being done at the rate of 800 to 1000 gallons a minute. Where the pumping is done by steam, the filling of the tanks is supervised by pumpers who tend the

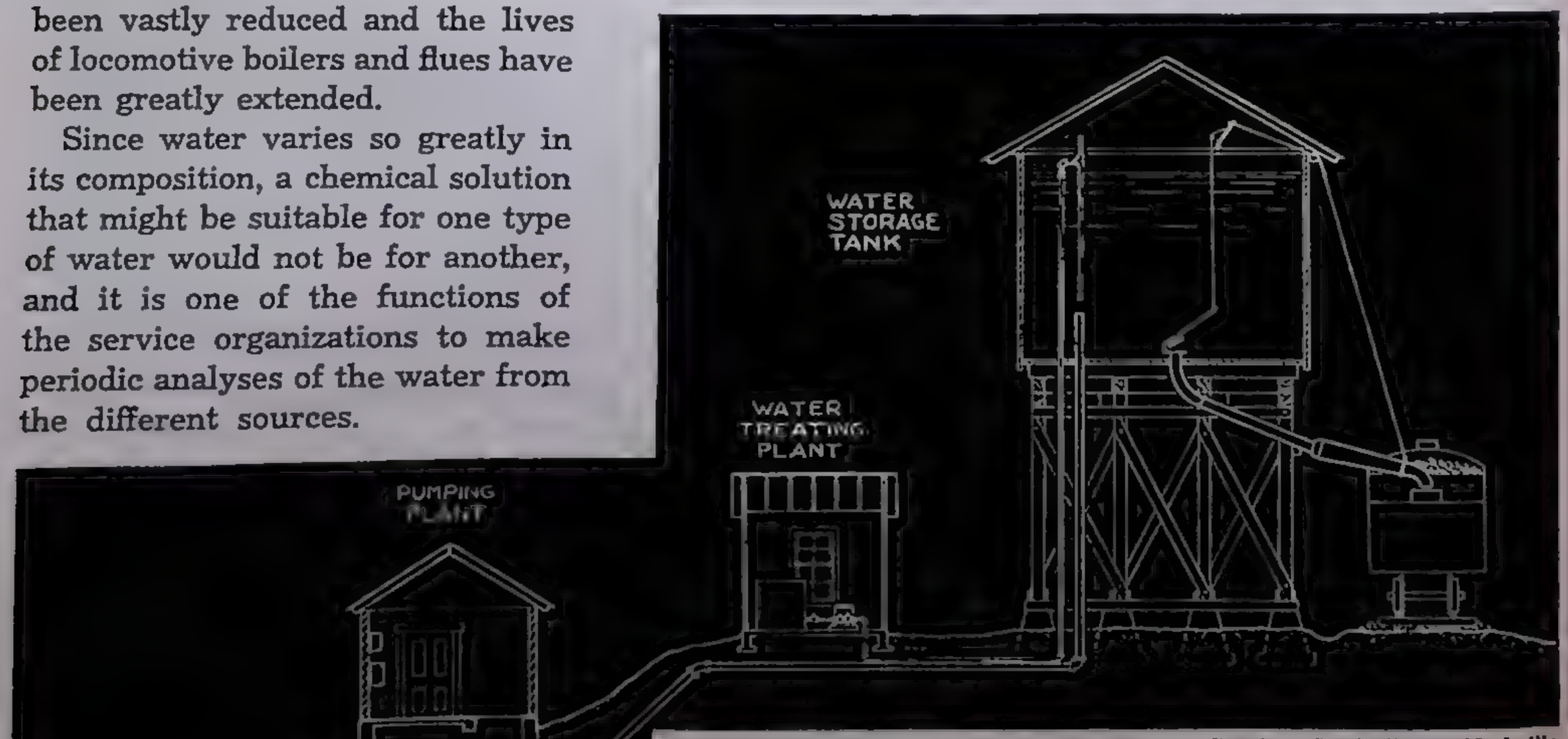
boilers and do other work around the stations. The L&N has about 200 of these pumpers. Some water stations work three tricks daily; other stations where the work is lighter have only the part-time services of one pumper, who takes care of two stations. Sometimes the pumping machinery is installed very close to its water tank; frequently it may be several miles distant and may supply two or more tanks. At Dortha, Ky., for instance, a 14-inch pipe extends for nearly four miles between the pumping station at Dortha and a reservoir near Corbin.

In recent years the L&N has been making an intensive and extensive effort to insure that the water supplied its locomotives and other facilities is of a suitable quality; hence a water-softening plant is generally situated adjacent to the water tank. This plant is housed in a modest shed; it consists of a cylindrical drum for the chemicals and various valves and pumps which work automatically, synchronized with the intake valve on the water tank. Thus, when a water tank takes a replenishing gulp of 10,000 or 20,000 gallons, the softening plant spices the drink with a chemical solution which will neutralize, precipitate or remove those elements which might decrease the efficiency of a locomotive by eating through its boiler tubes or by depositing a scale coating on the tubes and boiler. Water treatment has proved to be so efficacious that engine failures have been vastly reduced and the lives of locomotive boilers and flues have been greatly extended.

Since water varies so greatly in its composition, a chemical solution that might be suitable for one type of water would not be for another, and it is one of the functions of the service organizations to make periodic analyses of the water from the different sources.

Laboratories are maintained at Louisville, Lexington and Birmingham for this work. The chemicals are shipped in the form of balls, bricks, powders or liquids to the wayside softening plants and are there introduced into the water in accordance with the analysis previously made. While some of the water tanks have softening plants, others have a by-pass feeder arrangement positioned next to the tank's frostproof box (a housing around the pipes to keep them from freezing), by means of which the water being supplied to the tank passes through a tank containing the chemicals. A few stations do not have a softening plant of any sort, either because the water itself is of a good quality or because the demands upon the station are very light. Since nearly all water contains a certain amount of mud, it is necessary periodically to empty the tanks and give the interiors a good cleaning. The same result is achieved in the case of the locomotive boiler by the blow-down system. This operates while the train is in motion and removes not only mud, but the sludge, or deposit, caused by the chemical precipitation of the harmful ingredients in the water, and supplements the usual periodic boiler wash-outs at the roundhouse.

In addition to supplying water directly from a roadside tank, some roads, among them the L&N, also use water columns or cranes, which



Courtesy Louisville & Nashville.

Water from a lake or river (or a well) is pumped directly to the water storage tank, where it is mixed with a treating solution pumped from the intermediate treating plant. Lowering of the spout to the tender-filling position automatically opens a valve in the bottom of the storage tank.

operate on much the same principle as a water faucet, from a nearby tank. The water, seeking its own level, is forced upward and gushes out of the spout when the fireman or hostler opens the valve. Chief advantages of water columns or crane are that they take up less room than the water tanks and that several of them can be served by one tank.

Some railroads, chiefly in the East, supply their locomotives with water from long troughs which are positioned in the center of the track and which enable the engine to take a multi-thousand-gallon gulp while traveling at a high rate of speed. Nonstop operation is also achieved by the use of tenders in tandem or of super-sized tanks. No. 275, which hauls the *South Wind* nonstop between Nashville and Birmingham (205.4 miles), said to be the longest run of its kind in the country, has a tank capacity of 20,000 gallons, about double that of the ordinary tender.

A mighty important man in this business of carrying water to the iron horses is the pump repairman, whose title is not completely descriptive, it being his responsibility and that of his helper to maintain all the various pieces of water-supply equipment, ranging from drinking fountains and wash basins to pumps, supply lines, tanks, spouts, etc. Each division has three or four pump repairmen and their helpers.

Noel Hiram Deeks.

From storage tanks such as this one, approximately 600 billion gallons of water flow annually in the United States.

Courtesy Louisville & Nashville.

K. P. Howe, assistant engineer of water supply of the L&N, and a service engineer, P. D. Dempsey, analyze a sample of water in a titration test. Such tests are made at frequent intervals to assure a continued supply of good water.

Courtesy Louisville & Nashville.

At Dortha, Ky., the Louisville & Nashville obtains its water from behind a dam on the Rockcastle River. Pumping stations similar to this one are scattered throughout the United States to serve the 229,000 miles of steam-operated railroads which network the country.

By Edward Hungerford:

The Man in the Tower

BALTIMORE & OHIO fans are saddened these days to see the names being taken off the line's fleet P-7 passenger locomotives. To them it represents a step away from the Daniel Willard tradition. To lend the Iron Horse the distinction that properly was his by giving him a name of his own was one of the pet ideas of this great president of the B&O. It began back in the days of *The Fair of the Iron Horse*, when Colonel George H. Emerson, who was the road's outstanding locomotive head, brought out two big Mountain-type engines. Uncle Dan insisted that one of these be named the *Philip E. Thomas*, after the road's first president; the other became, quite properly, the *Lord Baltimore*. The idea was most favorably received, by press and by public. Mr. Willard proceeded to put it into further effect. At that time B&O was getting 20 extremely fine passenger locomotives. At the suggestion of its president, these were named after the first 20 Presidents of the United States, and as such, they became famous. Boys, young and old, watched eagerly for the *President Washington* or the *President Lincoln*, for each of the 20 beautiful locomotives, sleek in their liveries of olive-green and gold.

Other roads—to a degree—followed suit. The Southern painted its engines a bright green and named a number of them after its outstanding engineers. New York Central planned a mighty turbine locomotive (which never was built) and it was to be known as the *Niagara*, while the nice old Boston & Maine went into a perfect tailspin of naming locomotives—even designating one after a popular Metropolitan Opera star.

The new policy went further: Uncle Dan gave much time and thought to the road's dining cars. Upon its perfect breakfasts Baltimore & Ohio built a reputation that brought no end of profitable passenger traffic.

Willard insisted that the cars be finished inside in a colonial trim of mahogany and white with leaded windows that made them the handsomest dining cars in America. The final touch was to name each of them after a woman, distinguished in the annals of the land. The first of these was the *Martha Washington*—then came, in due course, the *Betsy Ross*, the *Nellie Custis*, the *Mollie Pitcher*, and still others. The idea caught on. Daniel Willard always was a past master of publicity. No idea that ever he brought forth received a more popular reception than this dining-car plan.

Now that idea also is being scrapped. The fine Willard tradition upon the B&O seems to be dying. Railroad fans are hoping that the road's energetic new president, Roy B. White, will not let it die. It is far too rare a thing to see real imagination and vision receiving its proper recognition upon our railroads.

SMART railroad executives long ago began to see how readily public interest might be translated into increased profits. If they had not, there would have been no streamlined locomotives and trains, no bright colors coming into favor once again as liveries for American passenger trains. Even through the stress of war these have been retained, and when comes the peace, they will be greatly increased. There still are imaginists among the big railroads. Ralph Budd, of the Burlington, is one of these; he proved it first when, as president of Great Northern, he caused the statue of John F. Stevens to be erected at the crest of the Continental Divide. . . . Edward S. French, of the Boston & Maine, is another. So is Ernest E. Norris, of the Southern. And the list by no means ends there.

This new feeling upon the American railroad also finds expression in some of the remarkably clever advertising done of late by many of the roads—as well as by their central organization in Washington, the A. A. R. A little of it is a bit mawkish and overdone, but most of it is good—very good indeed, and to be reckoned as an achievement.

IT IS a smart railroad that, even in these strenuous days of war transport, maintains its tradition and its individuality. The trend is likely to be in the other direction. Standardization and over-standardization between all the roads, which came as a natural result of the necessity for extreme economy in railroad operation, always tends to break down individuality—until, if carried through to its last lengths, it would make all our roads as alike as peas in a pod. The Chicago & North Western moved in that direction when, a few years ago, it removed its historic English-coach yellow from the sides of its passenger equipment and let these go into the dull and dingy Pullman green of most of the other railroads. Recently it has recognized its error in this step and now its newest streamliners—its outstanding *400's*—are back again in the system's traditional livery—a policy which, once started, probably will be carried forward until all the road's passenger equipment is back in the coach yellow once again. . . . Its distinguished rival, the Milwaukee, never forsook its own yellow—more of a pumpkin

shade than the lemon of the North Western. It has stood stoutly by it, just as the Pennsylvania always has refused to abandon its Tuscan red. The Pennsylvania has led other roads lately to adopt red for their passenger equipment. Perhaps the new management of the Alton, now that that road is standing upon its own feet once more, will again paint the *Alton Limited* in the deep red which once made it one of the handsomest trains in the land.

IT IS good to be able to state that the publicity sense of the average railroad here in the United States is increasing. The publicity representative of the railroad no longer is a poor, underpaid wight, stuck away in some dim corner and serving not less than half a dozen bosses. Today he is far more likely to rank as assistant to the president and to stand at all times close to the elbow of that august functionary. He is constantly uncovering new publicity angles and opportunities.

One of these still stands quite unused:

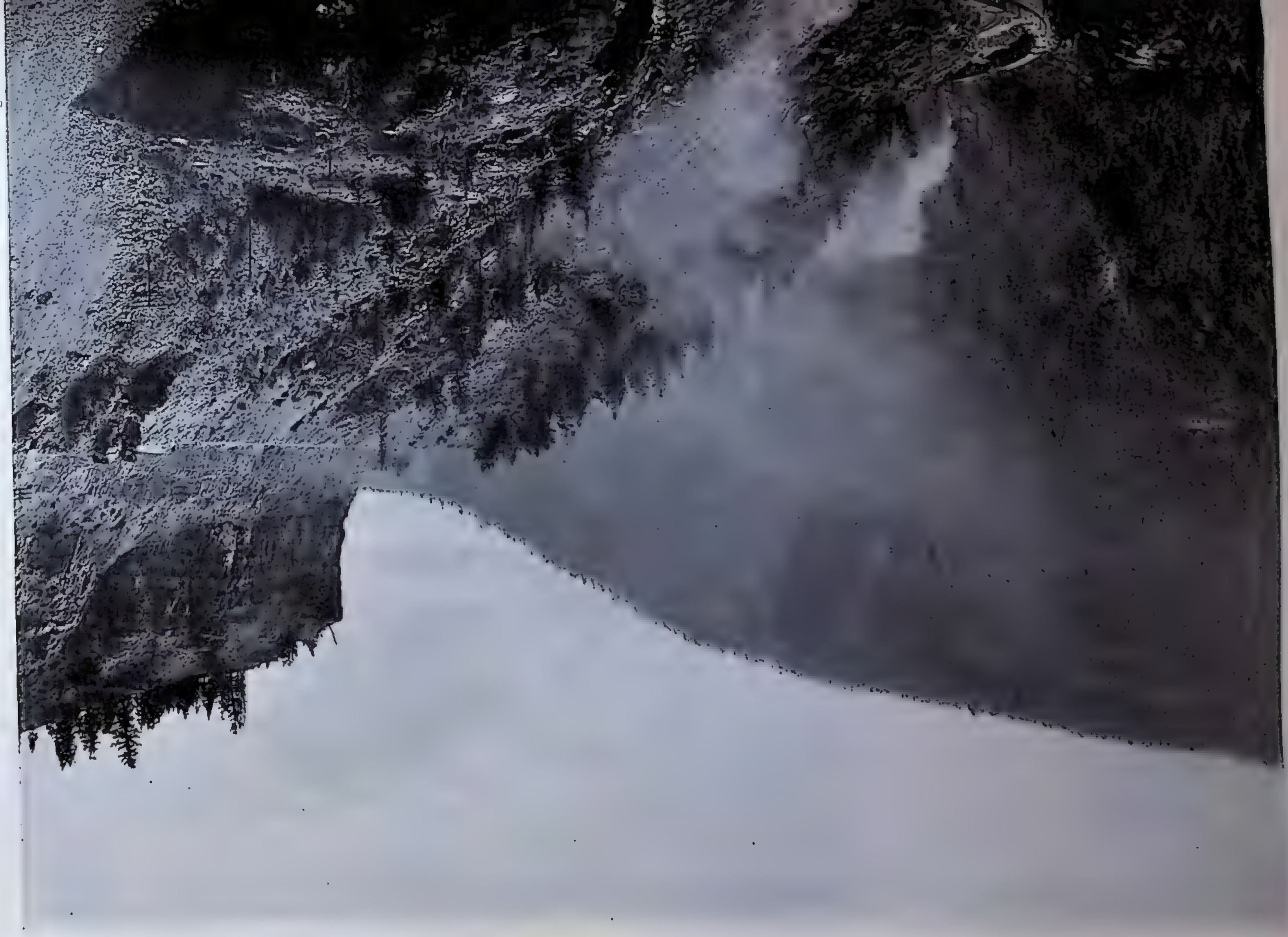
In a certain busy city upon the main line of an outstanding American railroad there is a passenger station with a great hall that easily can accommodate from 1500 to 2000 persons, without the slightest crowding. Frequently through the stress of the past winter, trains upon that railroad have been delayed from two to three hours at a time. Passengers waiting for trains or to meet inbound passengers have been forced to sit for weary hours in that great hall.

It would be a comparatively easy matter to suspend a movie screen high above the heads of all those people, and upon it flash the fascinating story of that railroad, and travel pictures as well. And perhaps an occasional newsreel or comic. . . . The road which owns that station is engaged in making a series of films of its story. But, once made, it has a rather hard time finding proper places to show them. The waiting rooms in the principal cities along the 12,000 miles of that busy system would be the ideal places.

Edward Hungerford

All B&O President-type Pacifics have been recently rebuilt and now look like the 5314, below. At right is the 5306 before rebuilding, pulling the Diplomat at Raritan River bridge.

Top, Herb Weisberger, 8708 21st Ave., Brooklyn, N. Y.; bottom, courtesy B&O.



Denver & Rio Grande Western.

D&RGW in Eagle River Canyon

The Denver & Rio Grande Western climbs through Eagle River Canyon from the Colorado River to the Continental Divide at Tennessee Pass.

Paracutin Volcano. By R. C. Morrow, Uruapan, Jalisco, Mexico.

Uruapan Express

IN THE pre-dawn of a morning in February, 1943, southern Mexico was rocked by a violent earthquake. A few hours later the quiet little town of Uruapan, off the main highway and at rail's end in the State of Michoacan in southwestern Mexico, woke up to find a newborn miracle at its gates. The Ferrocaril Nacional de Mexico (National Railways of Mexico) discovered with pleasurable surprise that it owned a railroad leading to a new world wonder—a rip-snortin' baby volcano!

The fact that the new volcano bubbled up near a village and in the vicinity of both a railroad and a highway is more astonishing than the statement implies. Only about 3 per cent of the towns and villages in Mexico are connected by motor roads, fewer still by rail. And a new volcano is a tercentenary phenomenon.

The birth of the volcano was dramatic. A humble Indian plowing his cornfield overturned a rock. Smoke emerged from the hole. He attempted to stamp it out. Failing, he clapped his *sombrero* over the opening. When the smoke increased in volume, he ran for help, abandoning his oxen, plow and hat. But no one could help him. He was the surprised and unwilling owner of the only baby volcano on earth, the first to appear in Mexico in almost 300 years.

Uruapan, 20 miles away, did not learn of the volcano till next morning. Uruapan ("Where Flowers Bloom") was founded in 1540 by a Franciscan friar, and Mexicans have always considered its environs the most delightful spot on earth. The village is a beguiling place where pleasant people with modest ambitions dwell in quaint, squat, white adobe houses with red-tiled roofs, in a balmy, almost perfect climate among lovely flower-crowned plazas. The air is laden with the perfume of roses and jasmine, and at dusk nightingales vie with strolling *mariaches* in making music. Patios flame with poinsettia blossoms, magnolia, heavy-scented roses. Pink geraniums climb to the eaves of houses. Vari-colored humming birds haunt the honeysuckle gardens. Orange trees laden with fruit, and perfumed flowers, mulberry, lime, pomegranate and quince, transform the surrounding environs into a Garden of Eden. On February 20, 1943, up jumped the Devil into this Arcadia and began terrible destruction.

That spring morning early risers living in this earthly paradise glanced with mild curiosity at an unaccustomed column of smoke a mile high silhouetted against the horizon at the end of the main street. Each went indoors to call the family to see it. Crowds collected. When

the smoke failed to disappear, curiosity changed to astonishment. Gradually an unnamed terror seized the onlookers. Many dropped to their knees and prayed aloud; others ran home for holy candles and, tapers in hand, hurried to the church to pray. By midmorning the tree-shaded plaza was filled with hundreds of kneeling men and women imploring divine intervention to preserve them from the machinations of the Devil.

That morning marked the beginning of the end of peace. A boom burst upon Uruapan.

Indians brought exciting tales of a new volcano, the power of which knew no bounds. The earth trembled. Heard above the underground rumble were titanic cries of the malignant rejoicing of demoniacal stentorian voices mingled with a sharp whistling. They told of glowing red-hot boulders weighing tons being hurled lightly into the air. Leaving their wives to pray, adventurous men of the vicinity set out on foot and by burro to gain a closer view of the inferno. Thus the trek began.

When foreign scientists began to arrive from afar and tourists taxed both rail and highway facilities in their eagerness to view this stupendous wonder, the Republic of Mexico woke up to the fact that it had indeed been endowed with something unique in the world.

By the third day the volcano, now called Paracutin because of its proximity to a village by that name, had built up a cone from the plains to a height of 100 feet and was exploding at regular five-second intervals. The growing crater belched out a steady flow of red-hot rocks, smoke, sand and gases, while the column of smoke attained an estimated height of from three to four miles before it spread out to form a ceiling over the little mountain valley, discharging a rain of fine black sand and ashes. A creeping stream of molten lava began to spill over the lower lip of the ever-widening crater, already a quarter of a mile in circumference. Earthquakes shook the entire area of the Michoacan Sierra south of the beautiful lake country.

The boom was on. Enterprising politicians managed to divert a trickle of the new money to their own pockets by erecting a toll gate on the wagon road leading to the volcano and charging 3 *pesos* (60 cents) admission. Among the few who failed to profit by the bonanza was the dazed Indian who owned the volcano. He received nothing. When a share of the "admission" was denied him, he reported to the higher authorities. The toll was quietly removed.

The crater grew with sinister regularity; day and night ashes fell steadily like a fine rain. Fields were buried; growing corn wilted and died; homes were devastated; birds and wild animals fled the area. Domestic creatures, their food supply gone, wandered bewildered, starving.

Uruapan, the starting point for visitors to the volcano, is situated about 320 miles from the capital as the crow flies, at the end of a branch line which connects with the Mexico-Guadalajara Railroad. In Mexico one does not compute a trip so much by distance as by the time required to negotiate a given distance. In going from Mexico City to Uruapan in the pre-Paracutin era, two changes were necessary: one at Acambaro and another at Morelia. When Mexico became involved in the war, sleeping and dining cars were withdrawn from this short, little-used branch line. To get to Uruapan from Guadalajara by rail was equally arduous, requiring a change at Panjama and another at Ajuno. Paradoxically, it was easier and quicker to go from Guadalajara to Mexico City or vice versa than to Uruapan, just half way between the two important cities. The former journey required 13 hours by fast through express; the latter, due to connections, approximately two days.

To facilitate travel in comfort to the new volcano, the National Railways of Mexico inaugurated a special weekend service. Passengers now board through American-style Pullmans on the *Paracutin Special* at Buenavista Station in Mexico City. This train departs at 8:20 p. m. and arrives at 7:20 the following morning at Acambaro, where a 20-minute stop is made for breakfast at the railway restaurant. Acambaro is the junction of the main line and short branch line leading to Morelia and Uruapan. From here the railroad traverses one of the most scenic areas in the republic. Michoacan, is one of the most

National Railways of Mexico gain an added tourist attraction as Paracutin Volcano spouts in a cornfield.

beautiful and productive states in Mexico. Fields of lush maize, pink with blossoming wild cosmos, are a delight to the eye. From the Pullman window the traveler sees crates of sweet oranges destined for the breakfast tables of the capital, and boxes of orchids piled on station platforms, the latter awaiting shipment to foreign lands. At noon the train makes a 20-minute halt for luncheon at Patzcuaro on the lake of the same name. It arrives in Uruapan at 2 the same afternoon. On the return journey the Pullman is dropped at Celaya on the main line, where it is hooked onto the Guadalajara-Mexico night express, and passengers arrive in time to breakfast in the capital.

I was surprised to find the railway station located a mile and a half east of Uruapan, but was pleased when the taxi charged only a *peso* (20 cents). One can ride the bus for 10 *centavos* (2 cents).

WHEN I visited Uruapan in pre-Paracutin days, it was a clean, sunny, tree-shaded town whose happy inhabitants occupied themselves in a leisurely manner with hand-weaving, carving, indigo dyeing, and especially with making the famous Tarasco lacquer ware. I resolved to return. I did return on June 1, 1943, just 101 days after the advent of Paracutin volcano. Uruapan was indeed a melancholy town. Once-white adobe walls were now blackened; red tile was coated with volcanic ash and many roofs had collapsed. In this once-thriving town a house with garden now retailed for as little as 100 *pesos* ($20). Sidewalks were black and gritty underfoot. Mounds of ashes three feet high, waiting to be removed, partly blocked streets. The federal government lent large trucks to aid the stricken town, and the work of keeping streets open was similar to a snow-clearance project.

From Uruapan my three companions and I took a car and set out for the volcano. The 17 miles over a rough wagon road through the woods to the village of Parangaricutiro required three hours. Here we changed to horses and rode the three remaining miles through a forest now more than three feet deep in ashes. Following a fine rain, falling ash adhered to leaves and limbs and wreaked havoc. Limbs were torn from some trees; others were split in halves by the weight of the wet ash. The effect was similar to an Oregon silver thaw. Beneath a fine black rain of water and ashes a desert of black ash rippled where once were gardens and fields of corn. Parangaricutiro was literally buried. Fearing their church would collapse, the Indians removed the figure of the Miraculous Christ to another village. They erected a cross before flowing lava as an anti-Devil gesture.

As we rode through the darkening forest in the late afternoon rain, flames from the volcano

The author (left) views Paracutin. Shelter later collapsed

lighted our way and we could hear the mighty roar and intermittent boom of exploding gases. After a 40-minute horseback ride we emerged from the forest, and I beheld the most awe-inspiring sight I have witnessed in my travels, which have taken me up and down and three times around the world. I have seen other volcanos in eruption—Kilauea and Mauna Loa in Hawaii, Asamayama in Japan, and Vesuvius in Italy—but none equaled Paracutin.

Roaring from the crater of a perfect cone, then 2500 feet high, a column of smoke shot skyward. Boulders the size of a house were being hurled upward by a gigantic force, accompanied by a rumble and boom as of cannonading. Heat lightning zigzagged up and down the column

Railroad Magazine had it first!

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Courtesy *Ferronales Magazine.*

This narrow-gauge line between Mexico City and Acambaro is one of two alternate routes to Uruapan.

of uprushing gases and smoke at an elevation of about a mile, while below, red-hot lava spilled over the brim of the crater and flowed slowly down the steep slopes, little red flames dancing in the moving liquid fire. Glowing boulders, hurled up from the nether regions, fell like giant red hail and struck the burning lava, causing a splash of liquid fire as they split into pieces and rolled with accelerating speed for two miles into the forest. Recurrent quakes caused the earth beneath our feet to tremble uncertainly. I shivered in woolens, ski jacket and rain *poncho*, for the temperature was bitterly cold. I also wore a broad *sombrero*, gauze mask and tightly fitting dark glasses as protection against falling ash and gases.

Despite the arduous trip, visitors were continually arriving and departing. At 9 o'clock we numbered some 50 seated on two long logs placed beneath a view shelter erected on the brink of the *barranca* which separated us from the inferno a half-mile distant. We had grandstand seats to watch a world in the making. An Indian woman did a brisk business with coffee, beans and *tortillas* cooked over a charcoal brazier. I shared my food with a poor half-naked old Indian man who shivered by a campfire at the north end of the shelter. This act was literally bread cast upon the water with immediate returns. By midnight only two of my friends, myself and the Indians remained watching the marvelous spectacle. An hour later the column of fire disappeared, though the rain of rock and ashes continued to resound upon the roof. I borrowed a *petate* (woven mat) from the Indian woman who dispensed coffee, and we three lay down to rest.

At 3 o'clock in the morning the roof above collapsed under the weight of falling debris. I awoke with a terrified start. Had the world fallen upon me? I was pinned down, unable to move, and the pain was terrific. We were buried alive. Thinking the shelter had been demolished by a red-hot boulder, I lay in stark terror, momentarily expecting another to strike. We cried for aid. Three newly arrived Mexican tourists viewed the wreckage with interest by flashlight but made no effort to come to our rescue. Mexican law forbids rendering aid to victims of an accident until after the arrival of the police. These were law-abiding citizens. But for the timely aid of the old Indian by the

campfire, who was uninjured and who dug us out, my two friends and I would have suffocated. My friends suffered a sprained ankle and back, respectively. My injuries were more serious. A falling ironwood beam fractured my pelvis in three places and paralyzed me below the hips.

Dragged from the debris by my two friends and the Indian, I lay upon a straw mat on the ashes, terrified by the continuous heavy rain of rocks and ashes and the trembling earth beneath me, for three hours in bitter cold until dawn. At daylight the Indians fashioned a stretcher from two pine saplings and their lassos and carried me to Parangaricutiro, where our car awaited. I arrived at the hospital in Mexico City 39 hours later. Here I remained for more than 2½ months. As I write this eight months later I am well on the way to recovery, living in the small Tarascan Indian village of Ajijic on the shores of Lake Chapala, more than a hundred miles west of Paracutin Volcano. During the past week Paracutin has showered a steady rain of fine black ash upon us. An area 50 miles in diameter has been completely devastated.*

It is a mere stroke of luck that the railroad leading to Uruapan is a comfortable standard- rather than narrow-gauge. Men who first interested themselves in railroads in Mexico thought in terms of narrow gauge, partly because of impossible grades and partly for reasons of economy of construction. As in the U. S. A., railroad magnates of the 1870's concentrated upon profitable return rather than upon service and comfort in travel for the public. Their sole idea was to make money. Builders in Mexico had an added advantage in government subsidy or concession, and they considered well the profits to be had from resale of a land concession.

No public service industry may be undertaken in Mexico without a concession. We have no exact equivalent to it in the United States. It is a contract between the government and the concessionaires for a definite period of years. Mexican railway contracts until the year 1880 were the result of individual bargaining between the government and the promoters, containing certain benefits and obligations to which both parties were subject.

The connecting of Guadalajara, second city in the republic, with the capital required time, and the building of the railroad is typical of others built in Mexico.

In 1870 General William S. Rosecrans, one-time U. S. Minister to Mexico, entered upon an adventure in railway construction. On December 10 of that year he received a concession from the Mexican Government for a railway line to extend from a point on the Gulf of Mexico in the State of Tamalpais to a point on the Pacific Coast between Zacatula and San Blas, with a branch line to Pachuca (famed for its rich silver mines), Queretaro, Guadalajara, Morelia, and Uruapan. His company was to receive 4000 hectares (1 hectare is approximately 2½ acres) of "waste land" for each kilometer of railroad (1 kilometer equals ⅝ mile) built. When he realized that the land received would run into the millions of acres, the wise general bethought himself that cash was safer. The government agreed to a subsidy of 8000 *pesos* per kilometer of rail in lieu of land.

That part of Mexico lying between latitudes 17 degrees and 22 degrees north is perhaps the most mountainous area in the world, and railroads traversing it do not run in a straight line as a railroad should, but curve and twist across the plateaus and over mountain passes—a scenic delight to the traveler; a graveyard for capital. General Rosecrans planned to build a narrow-gauge railroad, but his project was destined for failure. He forfeited his concession on February 1, 1873, when his company failed to pay to the government the 2000 *pesos* specified in the contract as "security."

Another company received the concession. Upon completion of the trunk line from Mexico City to El Paso, Tex. (Ciudad Juarez, Mexico), which was opened with a ceremony in March, 1884, the Mexican Central Railroad Company, which built the line, took over the project of connecting Guadalajara with this main line hence with the capital. This company's concession specified construction of a standard-gauge roadbed for which it received from the Mexican Government a subsidy of 9500 *pesos* per kilometer of rails laid. The work, begun in 1884, was completed four years later. This line was later extended to Manzanille, an important seaport on the Pacific Coast. Another branch connected Morelia and Uruapan with the Guadalajara-Mexico line.

It is over this historic line that the visitor to Paracutin Volcano travels in comfort in a train composed of rolling stock purchased in the United States.

* Recent reports are that Paracutin is gradually dying out.

Two Early Trains

No one knows exactly when these photos were taken, but that they are real relics of the past may be seen from the fact that the *Randolph*, below, was taken out of service more than 60 years ago, in 1879, and that the *Bay State*, above, was retired in 1882.

The *Randolph* was built for the old Colony Railroad by Hinckley & Drury of Boston, in 1846. The engine had 14" x 18" cylinders, 66" drivers and weighed 44,000 pounds.

Hinckley & Drury also built the *Bay State*, inside-connected like the *Randolph*. This was another Old Colony locomotive, with 14" x 18" cylinders, 60" drivers and weight of 46,500 pounds.

Cars on the Old Colony were painted yellow. In the bottom picture, cars were still in the flat-top stage, while above they had progressed to the clerestory era, affording better ventilation for travelers of the time.

Photographs from the collection of Charles E. Fischer.

Great Britain's Garratt Locomotives

BY O. S. NOCK.

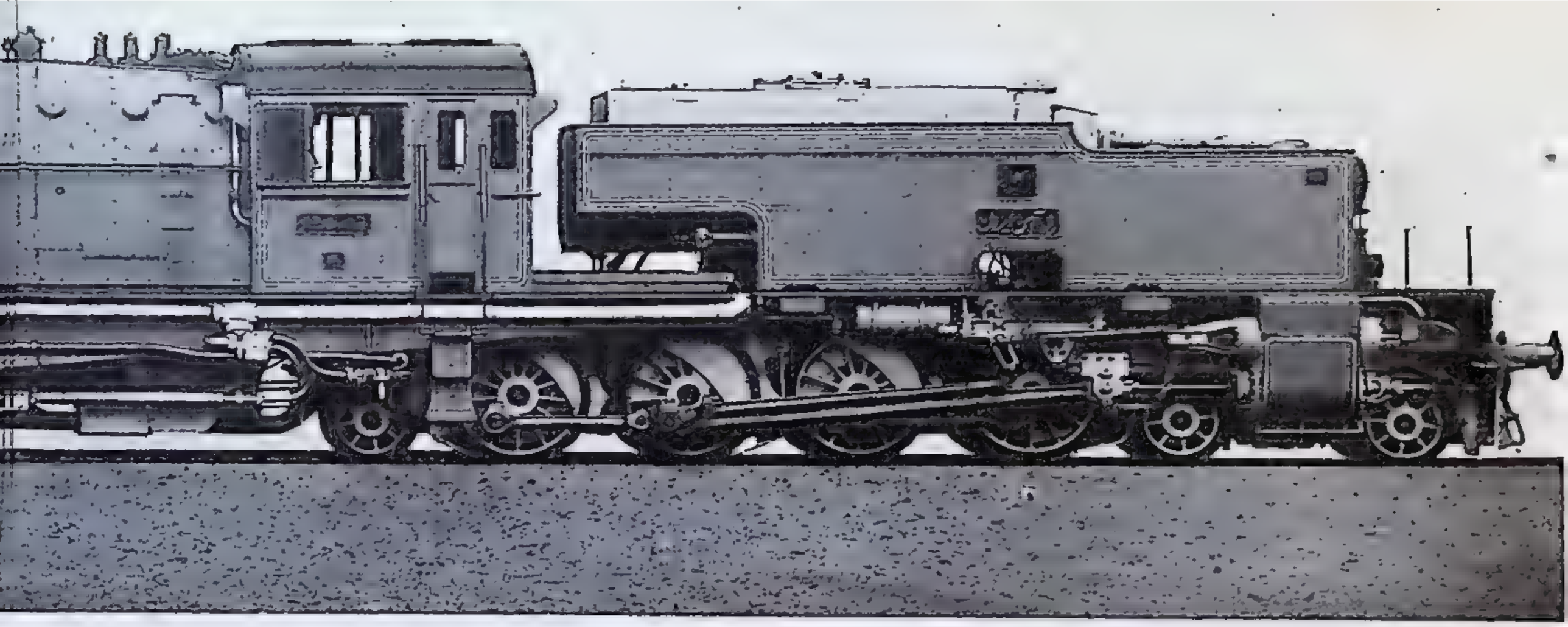
THE scene was in the Sudan, in the blazing heat of July, 1896. A mixed force of British and Egyptian troops under the command of Sir Herbert Kitchener advanced slowly up the Nile Valley, into a desert country scourged by hordes of fanatical dervishes. Here, in the strategic city of Khartoum not many years previously, a British garrison had been annihilated and General Gordon, its commander, murdered.

Kitchener's bold tactics demanded a more regular flow of supplies than could be furnished through the difficult navigation of the upper reaches of the Nile, and so, as the army progressed, a railway was driven step by step through the heart of the Nubian Desert. The need was urgent, and work was continued through the appalling heat of that summer. The thermometer touched 130 degrees in the shade; the desert was swept by sandstorms. Troops and railway workers alike were stricken with disease. Indeed, during one critical period, almost one-third of the British officers either died or were invalided. Still the work went on, and the fighting advance to Khartoum continued.

This desert line was lightly laid. The track, bridges, and layout generally were built to meet the needs of the immediate military situation and to carry supplies to the troops that would eventually garrison the Sudanese towns. When peace returned, this vital link with the North inevitably became a major artery of commerce and tourist traffic. Atbara, scene of fierce action during the closing stages of Kitchener's advance, is now the nerve center of the Sudanese railway system, and from this focal point the Garratt articulateds trundle their 1500-ton loads out into the dazzling sunlight of the desert, on a run of 300 miles southward to Khartoum and Wad Medani.

The circumstances in which business grew up on this railway are in many ways typical of desert and tropical countries. The urgent needs of the moment permitted no long-term planning, and, even in India, there were prominent and experienced engineers who asserted that a gauge of 36 inches was large enough to meet any requirements thereafter. Thus the legacy bequeathed by the pioneers in many parts of the British Empire is no sinecure. Traffic has increased enormously, and operating problems abound; severe curvature and heavy gradients are to be expected, but often they are experienced in combination with lightweight rails and slender bridges that permit no greater load than 22,400 pounds per axle.

The development of locomotive design to meet such conditions forms a fascinating study, particularly when seen against the colorful background of countries like Kenya, the Sudan, India, and Rhodesia. Even the main lines are largely single-tracked, and the passing sidings few and far between. So, with the double purpose of reducing line-occupation to a minimum and of providing economic haulage, it has become the usual practice to run a few very heavy trains rather than a number of lighter ones. The gradual increase in train loads has given rise to a variety of motive-power problems, particularly where the grades are heavy,



Over the 56½-inch-gauge Persian railroads, traffic is hauled by enormous Beyer-Garratts. Here is one of the several B-G locomotives now in use on the northern section of the Trans-Iranian Railways.

Difficult operating conditions at home and abroad fostered their intensive development.

All photos not otherwise credited, courtesy Beyer-Peacock & Co., Ltd.

and in many cases the physical limit of size for a rigid-framed locomotive has long since been reached, owing to the weight restrictions imposed by the nature of the permanent way, bridges and such. Though ordinary double-heading can only be regarded as a stop-gap measure, the placing of two engines under the control of one crew, in some form of articulated locomotive, has provided an effective and economical solution in the case of many substandard-gauge lines.

A form of articulated locomotive that has become very popular in the British Empire is that known as the Beyer-Garratt. It was in 1907 that H. W. Garratt patented his system of articulation, and two years later the firm of Beyer, Peacock & Company, Ltd., of Gorton Foundry, Manchester, turned out the first locomotive to be constructed on this principle. It was a four-cylinder compound for the Tasmanian Railways, having the 0-4-0+0-4-0 wheel arrangement and weighing no more than 73,000 pounds. All the modern Beyer-Garratts about to be described, however, are single-expansion machines.

Before considering any one design in relation to the local conditions existing on the particular railway, it is interesting to study the basic principles and operational characteristics of this type of locomotive. There are two independent engine units, arranged back to back and each having a massive pivot bearing just above the third pair of coupled wheels; these pivots support the central cradle that carries the boiler and fire box. The independent mounting of the boiler makes it possible to design a steam-raising plant of almost ideal proportions. There is nothing to restrict the girth of the boiler, nor the width of the fire box, and one of the outstanding characteristics of all Beyer-Garratt articulated locomotives is the shortness of the boiler in relation to its large diameter. In many countries where these engines are used the coal is of a compara-

Red Sea Hills, Sudan Ry.

tively poor kind, and on long runs of 800 miles or more, operated by one locomotive, steaming troubles might well be experienced with long boilers, particularly as they are usually hand-fired by natives. The short boiler and large firegrate area have proved a great boon in such conditions.

In a country like the Sudan, it is not merely a matter of designing a locomotive that will pull the load. The desert regions provide many problems of their own: driving sand, temperatures up to 160 degrees in the sun, and in many places a total absence of water. There is one stretch, indeed, where for 150 miles there is no possibility of watering the locomotives. Over the greater part of the system the gradients are not difficult, but in the Red Sea Hills, through which an important line from Atbara works its way to the coast at Port Sudan, there are about 16 miles of one per cent grade.

Long lengths of the main line, including the famous strategic railway across the Nubian Desert, are laid with rails weighing no more than 50 pounds per yard, and yet a locomotive was required capable of taking trains of 1500 tons over this lightly laid track. No greater load than 26,880 pounds per axle was permitted by the civil engineer. To meet these conditions, a Beyer-Garratt locomotive having the 4-6-4+4-6-4 wheel arrangement was designed. The two tanks have a total water capacity of 7000 gallons; the coal capacity of 26,880 pounds is notably high for a locomotive operating on 50-pound rails. The two engine units are controlled from a single throttle and from the same reversing gear, and both engines exhaust up the one smoke stack; thus the steam and exhaust pipes to the rear engine pass under the cab. It might be imagined that this would make things unpleasantly hot for the enginemen, though actually the cabs are so spacious and so amply ventilated that no such troubles have been experienced even in these extremely hot countries.

These engines are operated by Sudanese drivers and firemen. For all branches of the railway service, native labor has been extensively recruited and assiduously trained by British engineers, and nowhere, perhaps, is this policy so happily manifested as in the successful handling

In England or abroad, the B-G's perform heavy duty. Here is a six-cylinder 2-8-0+0-8-2 pushing a heavy coal train upgrade on the London & North Eastern Railway in England.

Courtesy London & North Eastern.

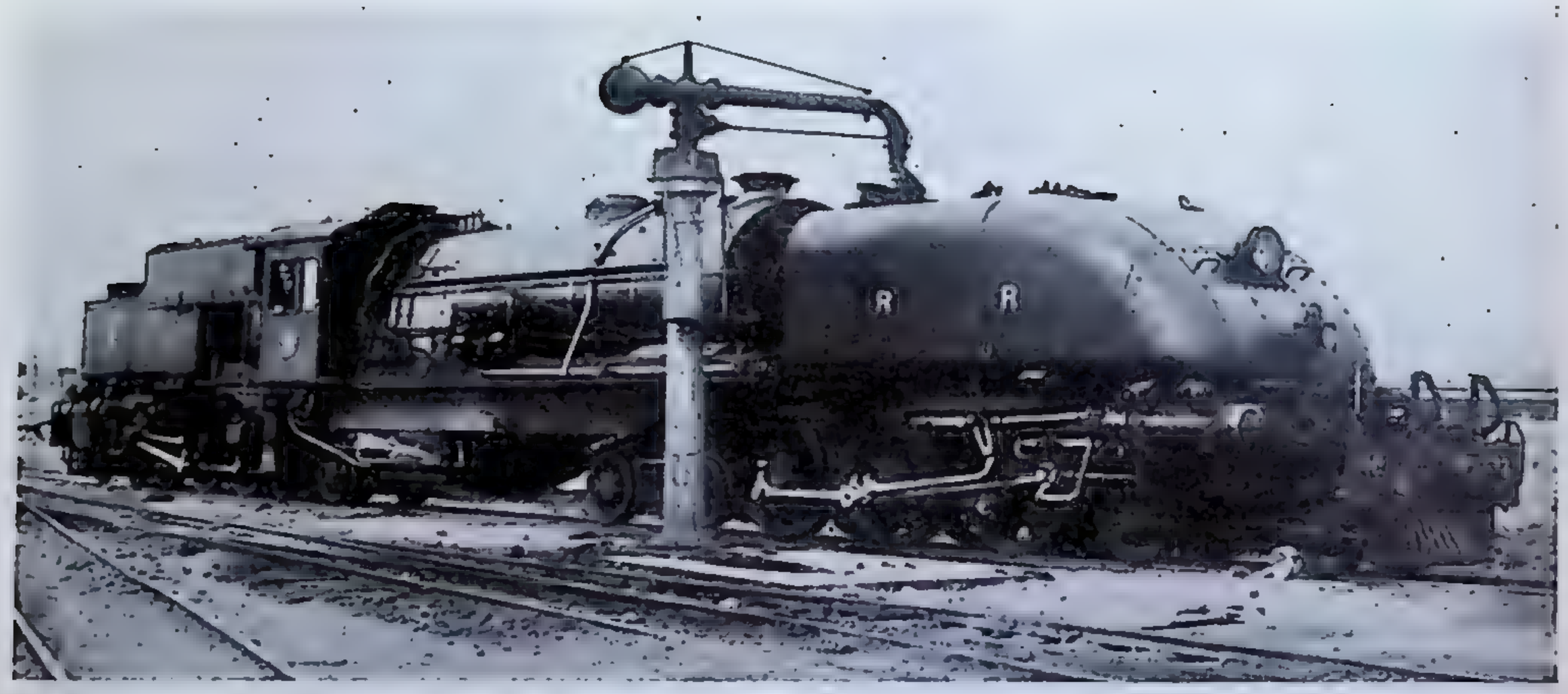
Against dense jungle, hostile natives and wild animals, railroaders fought to lay the track on which these B-G's now operate for the Kenya & Uganda Railway.

by a native crew of an articulated motive-power unit weighing 380,000 pounds.

In the very same year that Kitchener was driving his military railway across the Nubian Desert, work was commenced on another great African project: the Uganda Railway, a line 880 miles long from the port of Mombasa, on the Indian Ocean, to Lake Victoria Nyanza. This railway was built for the express purpose of stamping out the slave trade, which had its source in the interior of Uganda. Constructional work here was to some extent reminiscent of the first railways in the Sudan, for again the pioneers had to make a fighting advance; but, instead of combating the organized resistance of a hostile army, the builders of the Uganda Railway had to hack a path through dense jungle, with an escort armed to the teeth against attack by savages, the bulk of whom had never before seen a white man. In reports on the progress of the work made by engineers and surveyors one comes across entries such as "28 men have been killed by lions" and "the country is broken up into various petty tribes which are perpetually at war with one another."

Quite apart from such incidental troubles as the natives and the wild animals, the geographical obstacles to the building of a railway were tremendous. Much of the country is mountainous in the extreme, and it was only by resorting to severe curvature and heavy grading that a route was found at all. From the waving palm trees of the coastal belt, the line strikes out through jungle; then, climbing 1.5 per cent grades, it passes through country alive with big game, many kinds of which can be seen from the car windows; and then on to Nairobi, 330 miles inland and nearly 6000 feet above sea level, the capital city of Kenya and headquarters of the railway. Even heavier line work follows west of Nairobi, where the line ascends on 1.5 and 2 per cent grades to cross the equator at 9000 feet above sea level.

A route laid on the meter gauge, with 50-pound rails, two per cent gradients and curves of less than 600-foot radius, sounds like a good hunting-ground for Beyer-Garratts, and, sure enough, they are here in force. Almost the entire mainline traffic, both passenger and freight, is operated by locomotives of this type. There are two varieties in service at the present time: the 4-8-2+2-8-4, having a maximum axle load of only 23,520 pounds and used on both main and branch lines, and the larger 4-8-4+4-8-4 class, truly giants for the meter gauge, with an overall length of 97 feet and a weight of 417,500 pounds.



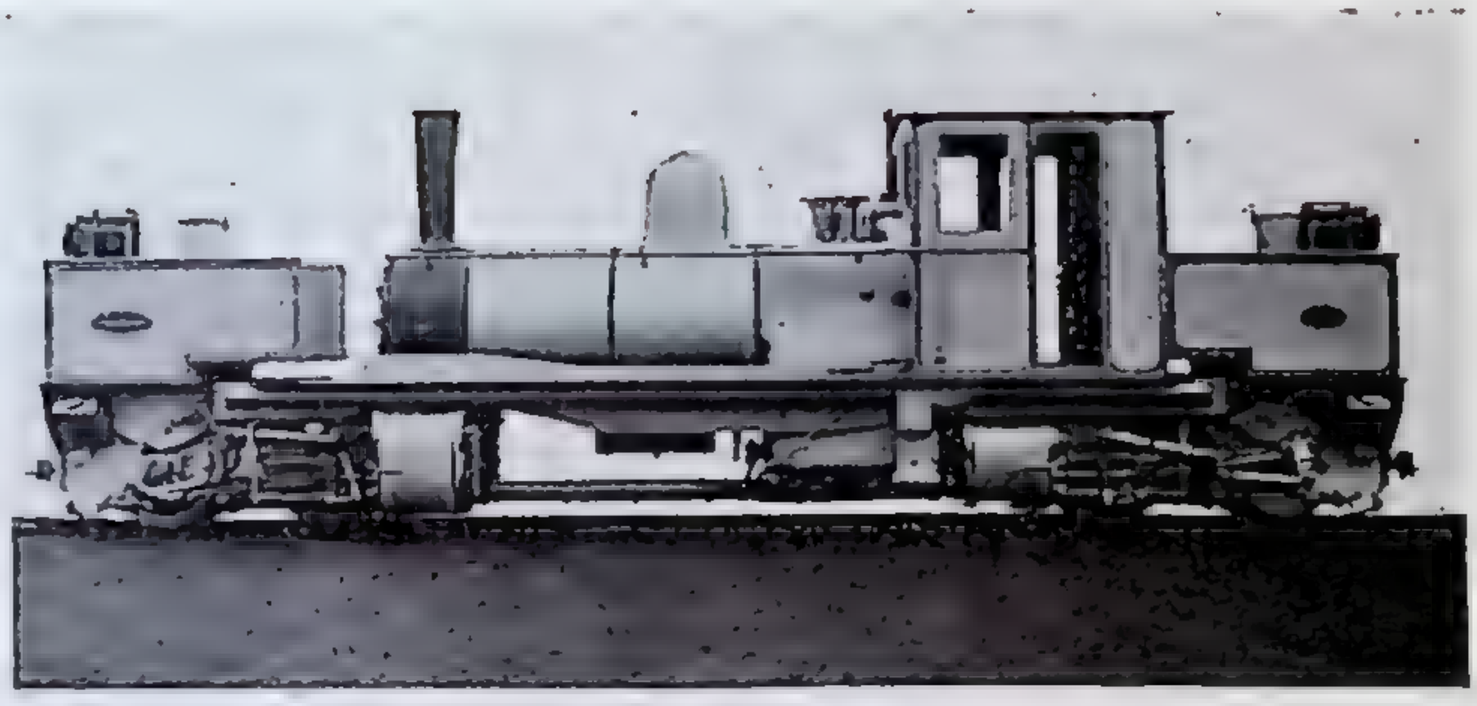
Thirty-six of the smaller engines are in service. They operate freight traffic in addition to the crack mail trains and passenger specials which are run in connection with ocean liners calling at Mombasa. They develop a tractive effort of 40,260 pounds at 85 per cent boiler pressure and are rostered to haul loads up to 450 tons on the two per cent grades. These engines make a daily round trip of 660 miles from Nairobi to Mombasa and back. Indian drivers are employed, with African firemen.

The 4-8-4+4-8-4 locomotives were designed to make round trips of 1100 miles from Nairobi to Kampala, the western terminus of the line. They develop a tractive effort of 46,090 pounds. The boiler has the enormous diameter (for meter gauge) of 78 inches and length of 143 inches. These proportions are even more remarkable considering that the total height of the locomotive from top of stack to rail level is only 149½ inches—11½ inches less than the comparatively low standard height permitted in Great Britain.

On these latest Beyer-Garratts for the Kenya & Uganda Railway—as the line is now known—a number of interesting features have been introduced to lessen the enginemen's responsibility and work on the road. All truck wheels are fitted with roller bearings, and special attention has been given to lubrication in view of the exacting service and long runs performed; wherever possible, grease is used instead of oil. The cab has been made especially roomy, no less than 108 inches wide—exceptional, this, for a locomotive operating on a rail gauge of only 39⅜ inches!

The exigencies of design in the case of the KUR engines are further brought out by comparing their leading proportions with those of the Beyer-Garratts working on the London Midland & Scottish Railway. In general, freight-train workings in Great Britain do not demand locomotives of exceptional power; the roads are for the most part finely graded, and the bulk of freight rolling stock is not braked. A 1450-ton mineral train will consist of about 87 four-wheeled wagons, and the only brake power will be that provided by the engine and tender and a 20-ton brake van at the rear. No substantial speeds can be maintained with such an assemblage, and Consolidation-type locomotives having about 35,000 pounds tractive effort are adequate for most duties. But on the Midland Division of the LMSR the axle loads are restricted; the gradients south of Leicester are heavier than on most of the lines running to London from the north, and from Toton concentration yards there goes a day-long procession of heavy coal trains over the 127 miles to Child's Hill—distributional point for the London area. Standard 0-6-0 and 0-8-0 locomotives were not powerful enough to take these trains unaided on the .75 per cent grades, and so a class of Beyer-Garratts was put to work. A tractive effort of 45,620 pounds was specified, about the same as that of the largest Kenya & Uganda engines; but against the maximum axle-load of 26,300 pounds laid down for the East African giants, the substantial LMSR road permitted a maximum load of 44,800 pounds. The requisite adhesion weight could be obtained with three coupled axles in each engine unit,

First of the Beyer-Garratts was the 73,000-pound 0-4-0+0-4-0 at the right. It was built in 1909 for the Tasmanian Railways. In Rhodesia, where trains run at altitudes of 4825 feet on 1.25 per cent grade single track, with passing places as much as 26 miles apart, 52 Beyer-Garratts "double" at freight and passenger hauling and prove equally efficient at both. The 4-6-4+4-6-4 on the opposite page is at work on the 186 miles of road between Gwelo and Salisbury.



instead of four, and the English Beyer-Garratts have the 2-6-0+0-6-2 wheel arrangement. This axle-loading on the Midland Division of the LMSR is low for modern British practice; on the Great Western Railway, London & North Eastern Railway, and on the Western and Northern divisions of the LMSR, axle loads up to 51,600 pounds are permitted. This last figure, compared with the East African maximum of 26,300 pounds, provides further evidence of the skill in design necessary to produce a locomotive developing 46,000 pounds tractive effort under all the exacting conditions found on the Kenya & Uganda Railway. The LMSR Beyer-Garratts have a grate area of 44½ square feet, and are fitted with steam-operated revolving bunkers which automatically feed the coal forward toward the shoveling plate.

All the locomotives so far described have four cylinders, two in each engine unit. The London & North Eastern Railway operates a Beyer-Garratt on pusher duty in the Barnsley district, with three cylinders to each engine unit. This locomotive was built to the specifications of the late Sir Nigel Gresley, chief mechanical engineer of the LNER, and the cylinders, motion and coupled wheels of each engine unit were made interchangeable with those of his standard three-cylinder Consolidations engaged on heavy freight and mineral traffic between Doncaster and London. The Beyer-Garratt was built purely for assisting heavy trains proceeding from the South Yorkshire coal field up a 2.5 per cent grade which ordinarily required the use of three Consolidations, two being needed for the through haulage of the trains. In contrast to the 1100-mile round trips worked by the KUR engines, No. 2395 of the LNER makes a trip only 2½ miles long, and then returns light; but she assists 18 trains every 24 hours—a daily movement of 18,000 tons of coal. With her tractive effort of 72,940 pounds, No. 2395 is the most powerful locomotive in Great Britain.

One could hardly imagine a greater contrast between the vast deserts of the Sudan, the primeval vegetation of the Kenya jungle, and the scene of the LNER Beyer-Garratt activities. The once fair hill country north of Sheffield is now gashed with coal mines and other evidence of a spreading industrialism, and in the dales artificial lakes provide water for the teeming populations of Sheffield and Barnsley. On the other hand, the LMSR Garratts do their hardest work through the smiling agricultural shires of the South Midlands of England, and pass by the fine old city of St. Albans within sight of its massive, yet mellow, cathedral built almost entirely of red tile from the vanished Roman city of Merulamium. From this historic site the railway closely follows the track of one of the most famous Roman roads—Watling Street—to the outskirts of London.

Dependable service.

Freight at an average rate of less than one cent a ton-mile: This extremely low-cost record is not the railroads' only claim to the freight business of the future. The railroad offers by far the greatest element of dependability, and this is more important than speed with most industrial freight. When you open your water faucet you don't care how long the water takes in the journey from the waterworks. All you care is that it keeps coming. Most industrial freight is a continuous movement, and the time involved in that movement is of minor importance as long as it doesn't mean too much interest value on the goods. But it is plenty important that the goods keep coming once the faucet is opened. By railroad the flow is steady and uninterrupted.

THE most powerful Indian Beyer-Garratts are at work on the Bengal Nagpur Railway, which serves the coal and mineral-working districts southwest of Calcutta. Like most of the Indian main lines, this railway is 66-inch gauge, and, with heavy rails and a finely ballasted road, axle loads permitted are higher than on the African substandard-gauge lines. There are several varieties of Beyer-Garratt locomotives in service, each designed to suit operating conditions existing on a particular section of line. An interesting recent example was worked out for a branch, 54 miles long, on which freight trains of 1760 tons are run; the heaviest grade is 1.1 per cent, the smallest curve has a 573-foot radius, and axle load is limited to 38,300 pounds. For this duty a locomotive having a tractive effort of 70,000 pounds was needed, and a wheel arrangement of 4-8-2 +2-8-4 was decided upon. To feed the four 20½" x 26" cylinders, a very large boiler was provided, and the fire box has a grate area of 70 square feet, a very large grate for hand firing! Two firemen per locomotive are employed. The wide gauge of 66 inches allows a roomy cab 120 inches square, so that there is plenty of room for the Indian crew.

On the Rhodesia railways, 42-inch gauge, there are now no less than 52 Beyer-Garratt locomotives at work. Many of these are used purely on freight service, as on the grandly picturesque route running northwest from Bulawayo to Livingstone and crossing the 650-foot steel-arch span over the gorge of the Zambesi River, within sight of Victoria Falls. But an even more striking application of the Beyer-Garratt system is to be seen on the northern end of the great trunk line running up from the Cape into the heart of Rhodesia. On a section 186 miles long, between Gwelo and Salisbury, four 4-6-4+4-6-4 Beyer-Garratts are at work. These four locomotives are used indiscriminately on goods and passenger trains, and have proved equally efficient in both classes of service. The road is a very heavy one, running at altitudes up to 4825 feet above sea level and including long stretches of 1.25 per cent grade; it is single-track throughout, and passing places are from eight to 26 miles apart.

The new Beyer-Garratt locomotives were designed to work on rails weighing 60 pounds per yard, and so were limited to a maximum axle load of 29,650 pounds. Even so, a nominal tractive effort of 42,750 pounds has been provided, and this ample power, on the 42-inch gauge, has enabled load limits to be fixed at 550 tons for mail trains, 850 tons for mixed trains, and 1050 tons for freight trains. In service under wartime conditions, the engines have been found capable of hauling loads considerably in excess of these stipulated maximums. The route includes much severe curvature, and throughout the section speed is limited to a maximum of 45 miles per hour. Engine 271, hauling the 687-ton *Rhodesia Express*, maintained a station-to-station average of 34.3 miles per hour over the eight miles from Hartley to Gadzema, showing a fine acceleration for such a load.

ALL locomotives so far described are designed for optimum performance at comparatively slow speed. The Sudan and KUR examples are run up to 45 miles per hour at times, but such spurts occur on favorable gradients, or on a level road; it is another matter when a locomotive is required to haul big loads on heavy ascending grades and at other stages in the same journey, to develop a high power output at 70 miles per hour or more. With the ordinary Walschaert valve gear it is difficult to arrange for equally effective steam distribution at both early and late cutoffs, and the use of a comparatively late cutoff at high speeds tends to reduce the thermal efficiency.

Garratts are versatile.

Comparative record of Beyer-Garratt engine 271 in passenger and freight service on the Rhodesia Railways, 42-inch gauge.

Miles between stations	Stations	Average gradient between stations, per cent	Speed from station to station: The "Rhodesia Express," 687 tons	Speed from station to station: No. 53, Down (goods train) 1052 tons
	Gwelo			
24	Hunters Road	0.34 Down	35.1	20.6
17	Que Que	0.27 Down	30.9	21.7
26	Battlefields	0.23 Down	30.0	16.4
11	Umsweswe Siding	0.24 Down	31.4	20.6
11	Gatooma	0.50 Up	28.7	22.0
20	Hartley	0.08 Up	31.6	19.1
8	Gadzema Siding	0.24 Down	34.3	24.0
21	Makwiro	0.48 Up	30.7	20.7
22	Norton	0.17 Up	26.9	19.1
26½	Salisbury	0.24 Up	28.4	16.7

Some members of the Garratt family.

Railway	Gauge, inches	Maximum axle load, pounds	Tractive effort at 85% boiler pressure, pounds	Wheel arrangement	Cylinders, D. and S., inches	Driving-wheel diam., inches	Boiler press., pounds	Boiler diam., inches	Boiler length, inches	Grate area, sq. ft.	Total heating surface, sq. ft.	Total weight of engine, pounds
Sudan	42	26,880	43,500	4-6-4+4-6-4	4—16¾ x 26	57	200	72	149	43.2	2400	380,000
Kenya & Uganda	39⅜	23,520	40,260	4-8-2+2-8-4	4—16½ x 22	43	170	72	144	43.6	2437	300,500
Kenya & Uganda	39⅜	26,300	46,090	4-8-4+4-8-4	4—16 x 26	54	220	78	143	48.5	2750	417,500
Persian State	56½	33,100	61,800	4-8-2+2-8-4	4—19¼ x 26	53⅛	200	90	173	68.0	4484	450,240
LMSR (England)	56½	47,040	45,620	2-6-0+0-6-2	4—18½ x 26	63	190	75	144	44.5	2637	347,000
LNER (England)	56½	39,770	72,940	2-8-0+0-8-2	6—18½ x 26	56	180	84	156	56.5	3640	376,000
Bengal Nagpur (India)	66	38,300	70,000	4-8-2+2-8-4	4—20½ x 26	56	210	84	173½	70.0	4114	515,200
Algerian	56½	40,320	58,102	4-6-2+2-6-4	4—19¼ x 26	71	284	81	175	58.0	3769	476,000
Rhodesian	42	29,700	42,750	4-6-4+4-6-4	4—17½ x 26	57	180	78	151	49.5	2830	402,000

The need for providing new motive-power units to work equally hard and efficiently at both ends of the speed scale arose, a few years before the outbreak of war, on the Algerian railways. Eastward from Oran, the main line to Algiers, Constantine and Tunisia includes much severe grading, but also long stretches of well aligned road on which speeds up to 75 miles per hour are permitted with ordinary locomotives. The Atlas Mountains are ascended on grades of 2.6 per cent, and double- and even triple-heading was necessary with heavy trains. For this hill-climbing duty the Algerian administration decided to use Beyer-Garratt locomotives, but in 1932, with the object of investigating the behavior of such a machine on *all* sections of the main line, an experimental Beyer-Garratt engine was built with 71-inch driving wheels and designed for a service speed of 65 miles per hour on level track.

While locomotives of the Beyer-Garratt type already in service in many parts of the world had shown very good riding qualities, even in the case of large and heavy units operating on substandard-gauge roads, 60 miles per hour was about the maximum speed so far attained. The experimental Algerian Garratt was of the 4-6-2 +2-6-4 wheel arrangement, and each engine unit embodied much that was characteristic of French express-passenger Pacific locomotive practice at the time, except that the Garratt units were noncompound, each having two 19¼" x 26" cylinders. The valve gear was Walschaert.

This experimental locomotive proved outstandingly successful. Although a trial speed of 68 miles per hour had been specified, the action was so smooth and steady that the original service requirement of 65 miles per hour was withdrawn, and the engine was permitted to run up to the 75 miles per hour limit in force throughout the Algerian railway system. Then, with the object of still further testing the capacity and riding qualities of the engine, the limit was relaxed on a selected length of track, and on a special test run the remarkable speed of 81 miles per hour was attained—easily a record for a Beyer-Garratt.

But, while the riding at high speed was most satisfactory, the thermodynamic performance showed room for improvement. Using these experiences as a basis, a modified design was worked out in which the most important changes were an increase in boiler pressure from 227 to 284 pounds per square inch and the substitution of the Cossart valve gear, designed by Leon Cossart, chief works manager of the Northern Railway of France, and applied a few years previously to some 2-8-2 suburban tank locomotives with remarkable success. Cossart aimed at getting an improved steam distribution by making the point of admission independent of the cutoff; this could not be done by using an ordinary reciprocating mechanism, such as the Walschaert, so he designed a cam-operated gear, with independent control of the admission and cutoff cams. How effective this system proved in service was shown by some test runs with the Nord 2-8-2 tank locomotives between Paris and Creil, when one of this class hauled a load of 475 tons up a grade of 0.5 per cent at 70 miles per hour on no more than 10 per cent cutoff. These locomotives weigh 268,800 pounds and have 25¼" x 27½" cylinders; boiler pressure is 261 pounds per square inch and the driving wheels are 61 inches in diameter.

This gear has proved equally successful on the enlarged Algerian Beyer-Garratt locomotives, permitting fast and efficient running at cutoffs as low as five to seven per cent and at

Optional routes.

For the benefit of those who must travel but who cannot get accommodations by their usual route, TRAINS each month will print a brief listing and survey of available routes between larger cities.

Chicago and Cleveland:

New York Central—Via South Bend, Elkhart, Toledo, Sandusky. Five day and evening trains, two overnight trains with sleepers.

Nickel Plate—Via Fort Wayne and Fostoria. One day train, one overnight train with sleepers on competitive schedules.

Pennsylvania—Through overnight sleeping car via Fort Wayne on slightly longer than competitive running time.

the same time enabling full use to be made of the high nominal tractive effort of 58,102 pounds on the heavy gradients.

These locomotives include a number of very interesting features. Adjustment of cutoff is electrically controlled, and the small control lever in the cab is duplicated on the fireman's side for use when the engine is running bunker-first. The climate of Algeria being most oppressive during several months in the year, careful attention has been paid to the ventilation of the cab; special ventilating skylights are fitted in the roof, and a turbo-fan pumps cool air from the ground into the cab when passing through tunnels. The grate area is 58 square feet, and mechanical stokers are now being fitted. Both bunker and the forward water tank are cylindrical in shape, and they impart a highly imposing appearance to the locomotive as a whole.

The experimental engine of 1932 was tested in express passenger service on the Paris, Lyons & Mediterranean Railway before being shipped to Algeria; in a similar way one of the new class, with the improved boiler and valve gear, was loaned for a time to the Northern Railway of France in 1937. During this period the engine worked on some of the famous *rapides* between Paris and Calais—trains scheduled to cover the 184 miles at an average speed of 58 miles per hour. These trials were made more for the purpose of testing the riding qualities than of obtaining records of high power output; the *rapides* were not augmented in load, and they were at that time worked single-handed by Pacific locomotives having little more tractive power than one of the two engine units incorporated in the Algerian Beyer-Garratt.

Under a viaduct near Elstree, England, a Beyer-Garratt 2-6-0+0-6-2 passes with a lengthy train of coal empties on the London Midland & Scottish Railway.

RAILROAD JOBS...

RAILROADS NEED

Machinists	Linemen Helpers
Boilermakers	Bridge and Building Carpenters
Blacksmiths	Bridge and Building Helpers
Sheet Metal Workers	Maintenance of Way Laborers
Electricians	Shop and Roundhouse Laborers
Carmen	Brakemen
Helpers, All Crafts	Switchmen
Apprentices, All Crafts	Firemen
Signalmen	Telegraphers
Signalmen Helpers	Station Clerks
Linemen	Yard Clerks

BACK THE INVASION

Railroads must have *more men—more women.*

As preparations go forward for the decisive assault on Hitler's Fortress of Europe, greater tonnages of war freight must be delivered on schedule to ports of embarkation. Troops must be moved swiftly and safely. The flow of materials to war industries must continue without interruption.

To do this job, railroads must have *more men—more women.*

6,000 Great Northern employees are in the Armed Services—most of them *experienced* railroad workers. All railroads are operating under similar handicaps—while *handling more than twice the volume of traffic moved during the first World War.* And the peak demand is still ahead.

Draft boards, as a whole, appreciate the importance of railroad jobs—have been cooperative. But to meet their quotas they have had to take men whom the railroads could ill afford to lose.

These employees must be replaced by other men and women who are not presently employed in war industries at their highest skills or in the production of food and other necessities.

Invasion days will be anxious days. They will be days when every true American will want to be *doing something* to support the sons, brothers, fathers and friends who will be fighting for footholds on Hitler's shores.

Back the invasion with a railroad job—a job with *action.*

Many jobs are open to men and women who have had no previous railroad experience. Apply in person or write to the nearest

U. S. RAILROAD RETIREMENT BOARD
Employment Service
or
U. S. EMPLOYMENT SERVICE

Or inquire of any railway agent or at any railway office.

Railroad employment offers good wages, security under Railroad Retirement and Unemployment Insurance, and transportation privileges.

● This advertisement, now appearing in newspapers throughout the Northwest, is reproduced in this publication so that its readers will be aware of the manpower problem which confronts the railroads.

GREAT NORTHERN RAILWAY

EX-MARINE

John E. Deithloff

"Sentry of the Signals"

John Deithloff, who began his "North Western" career in 1909, is well aware of the importance of his job. He says, "War has the right-of-way now and we've all got to do our part to see that fighting men and materials are transported safely."

John's work calls for patrolling some 20-odd miles of track between Proviso Yard and Valley, day in and day out. He inspects . . . he tests . . . he checks. Automatic block signals, automatic crossing gates, wigwag and flasher signals—all these and more must be maintained in perfect working order. Safety decrees it—victory demands it.

"North Western" depends on John Deithloff and men like him to help safeguard its right-of-way. But this ex-Marine fighter, who fought overseas in World War I, has something *extra special* to be proud of—three sons and a daughter in service.

Emulating their father's example, 21-year-old Richard and 20-year-old Donald are members of the Marine Corps—now somewhere overseas. Seaman Allen, 18 years old, is serving on the U. S. S. Hazelwood. While Ruth, who enlisted a year ago, proudly wears the uniform of the WAVES.

But it matters little to the Deithloffs where they serve in this war *just so long as they are privileged to serve.* How grateful we should be that here in America there are millions like them!

SERVING AMERICA IN WAR AND PEACE FOR ALMOST A CENTURY

CHICAGO and NORTH WESTERN LINE

Women Railroaders

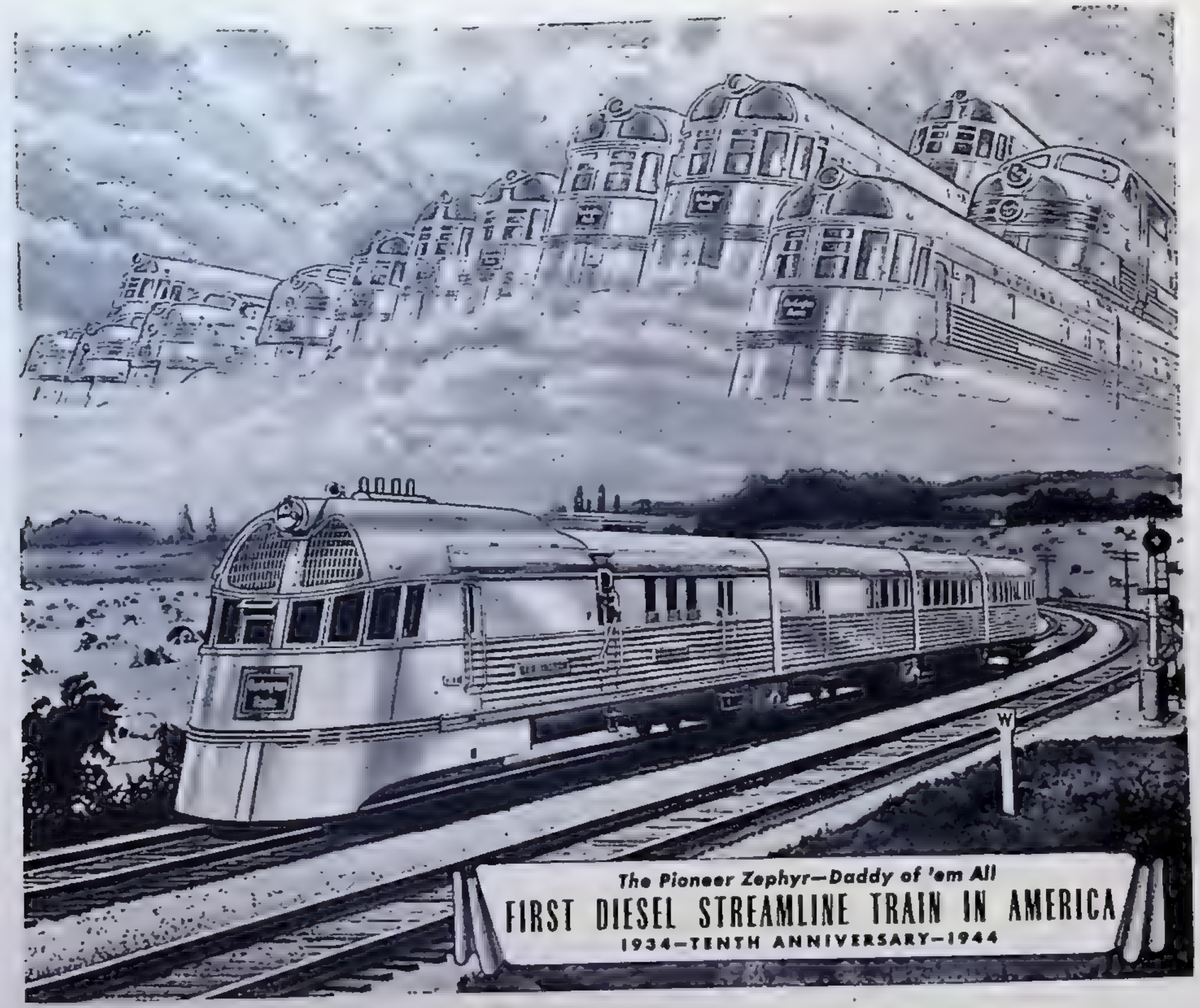
In mid-January of this year the United States railroads had 105,901 women in their employ, nearly 10 per cent of all employees. Railroading was once almost exclusively a man's domain. Susan Morningstar appears to be the record holder for the first woman employed on the railroads. This was back in 1855, and poetically named Susan was a scrubwoman. The first woman in a railroad "white collar" job was Mary Williamson Mellor, telegraph operator, who entered railroad service in 1875.

During World War I a large number of women were taken into railway service to replace men, but the number and variety of jobs handled by them are small compared to the present situation. This war has affected railway personnel in two ways. First, the extraordinary wartime demands for transportation, added to civilian transportation needs, has made it necessary to add substantially to operating forces. It took about 290,000, or approximately 30 per cent, more employees to operate the railroads in 1943 than in 1939. Second, this war has drawn more heavily on personnel than World War I, when only one out of eight employed went into military service. The figure now is considerably higher and with each day more skilled railroad men are being called.

It has been estimated that 105,000 women are

Courtesy D&RGW

Dorothy Pennington, 19 (left), and Mrs. Edna Berry, 21, sisters, are proving their mettle on tough jobs which until now were reserved for he-man railroaders. They are "number snatchers" in the Denver & Rio Grande Western's Grand Junction yards.



MORE THAN A TRAIN . . . A SYMBOL

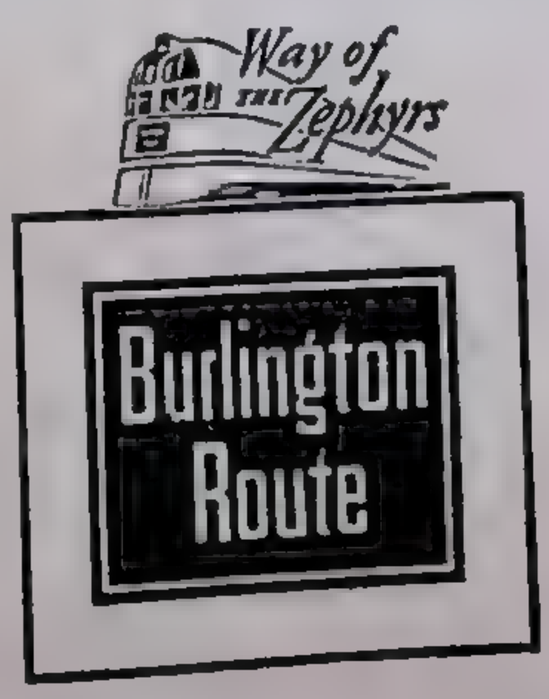
● Burlington's Pioneer Zephyr, first diesel-powered, streamline train in America . . . symbol of a dramatic era in railroad transportation . . . and of the even more dramatic progress to come.

Christened on April 18, 1934 . . . exhibited in 222 cities in 27 states . . . tested through 30,000 experimental miles, the Pioneer Zephyr entered regular service with national acclamation, on November 11, 1934 . . . thus establishing the first streamline service in America.

Today, the Burlington has fourteen gleaming stainless steel Zephyrs operating on its system lines. More than 100 trains, fashioned to the streamline pattern, have gone into service for railroads throughout the country.

With ten years of outstanding service to its credit—a period during which it has covered in excess of 1,676,000 miles—the Pioneer Zephyr is still on active duty, serving wartime America to the tune of 456 miles each day.

In the coming peacetime years, we look forward to a program of further improvement and refinement of the "streamline train" era, inaugurated by the Pioneer Zephyr ten years ago.



AN ESSENTIAL LINK IN TRANSCONTINENTAL TRANSPORTATION

Railroad Books

ALBUMS OF RAILROAD PHOTOS—The finest collection of railroad photographs, printed on super-glossy paper with glossy ink. Just like original photographic enlargements. Interesting descriptive text. In four volumes, cardboard covers, ring binding:

(1) Book 1—Eastern Railroads $1
(2) Book 2—Far Western Railroads $1
(3) Book 3—Midwestern Railroads $1
(4) Book 4—Colorado Railroads $1
(5) Set of all four books $4
(6) All four in deluxe limited edition, heavy library binding $10

RAILROAD PANORAMA—(7) By A. C. Kalmbach, editor of *Trains*. 20 of the most interesting chapters from American railroading colorfully and accurately told. 224 pages of text, 32 pages of excellent photos. $2.75.

RAILROAD PICTURES

NOONDAY WATER STOP—(8) A watercolor painting by Gil Reid, faithfully reproduced so only an expert can tell it from the original. Shows a light Pacific taking water at typical small town. Painting size 9" x 14", on heavy paper 12½" x 19", so you can have it framed with margin to suit your taste. A beautiful picture for any place in the home. $1.

(9) **KODACHROME** picture, 14" x 9", of the largest locomotive in the world, Union Pacific's 4-8-8-4 articulated, leaving Green River, Wyo., with a freight train. A beautiful scene printed with the utmost of color realism and clearness, with wide margin for framing. $1.

WESTBOUND FREIGHT—(10) By Kent Day Coes. A watercolor painting of same size as above, shows the caboose end of a fast freight going around a curve. Lots of action, beautiful highlight treatment of the colors. $1.

WAY STATION—(11) Reproduction of an oil painting by A. Sheldon Pennoyer. An old-time scene which captures the romance of early railroading. Print size 14" x 9" on heavy paper, 19" x 12½". $1.

RAILROAD MAPS

PENNSYLVANIA—(12) 17" x 22" three-color lithographed map showing every railroad in the state, including narrow-gauge, interurban, and abandoned, and topography, rivers, etc. Complete index. 50 cents.

COLORADO—(13) 24" x 38" four-color lithographed map of the railroad wonderland state, including every railroad that does or did exist and even important projected lines. 15 large-scale inset maps of interestings areas. $1.

Either or both maps rolled in tube, 50c extra.

All items postpaid. No C.O.D. orders.

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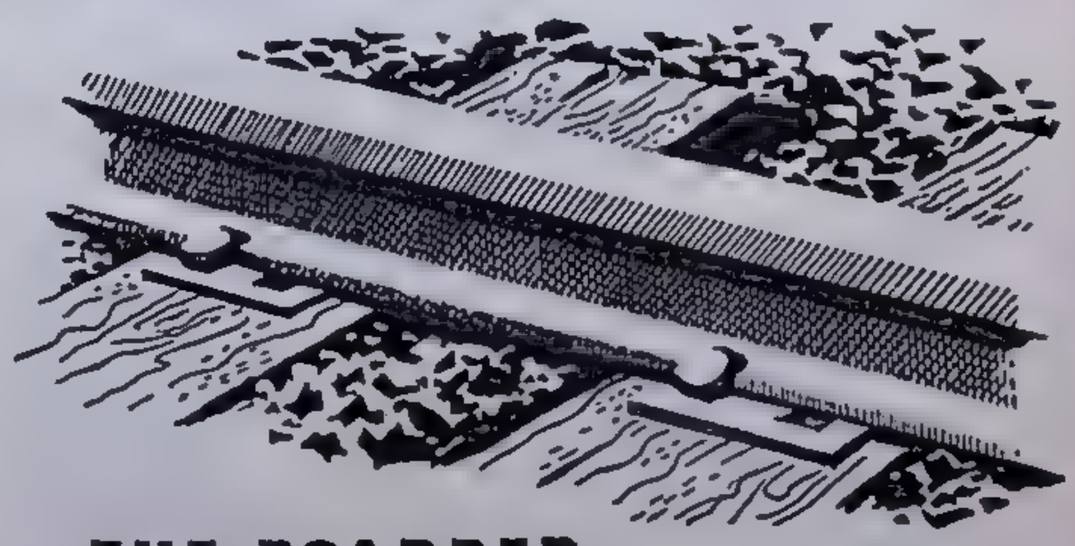
able to release 100,000 men in the railroad industry, due to the varying ability of women to handle laboring jobs because of the difference in physical strength. When it comes to technical and mental ability, women have stepped forward and proved themselves the equal of men who formerly held positions calling for executive skill. We have, for example, women railroad presidents, a board chairman and corporation secretaries. An eastern railroad recently appointed a woman auditor, while on one of our largest systems women hold such high positions as purchasing agent, superintendent of dining car service, and travel-bureau manager.

In other activities in the railroad industry women have admirably taken over. Listed in a recent I. C. C. report are these jobs which were formerly done only by men:

Bridge and building painters, 6.
Gang or section foremen, 1.
Section hands, 1185.
Blacksmiths, 2.
Boilermakers, 5.
Machinists, 129.
Sheet-metal workers, 9.
Lieutenants and sergeants of police, 6.
Claim agents or investigators, 31.
Bridge operators and helpers, 5.

NOT FORGETTING



THE ROADBED

The C&EI has long been noted as having one of the finest roadbeds in America. Its St. Louis Division—the famous Noiseless Route—heavily ballasted all the way, is so smooth and level that it has become known as "The Boulevard of Steel."

That fine roadbed has been a mighty big asset in helping the C&EI to handle its full share, and more, of America's tremendous war job—hauling tonnages and passenger totals far beyond anything in its history..

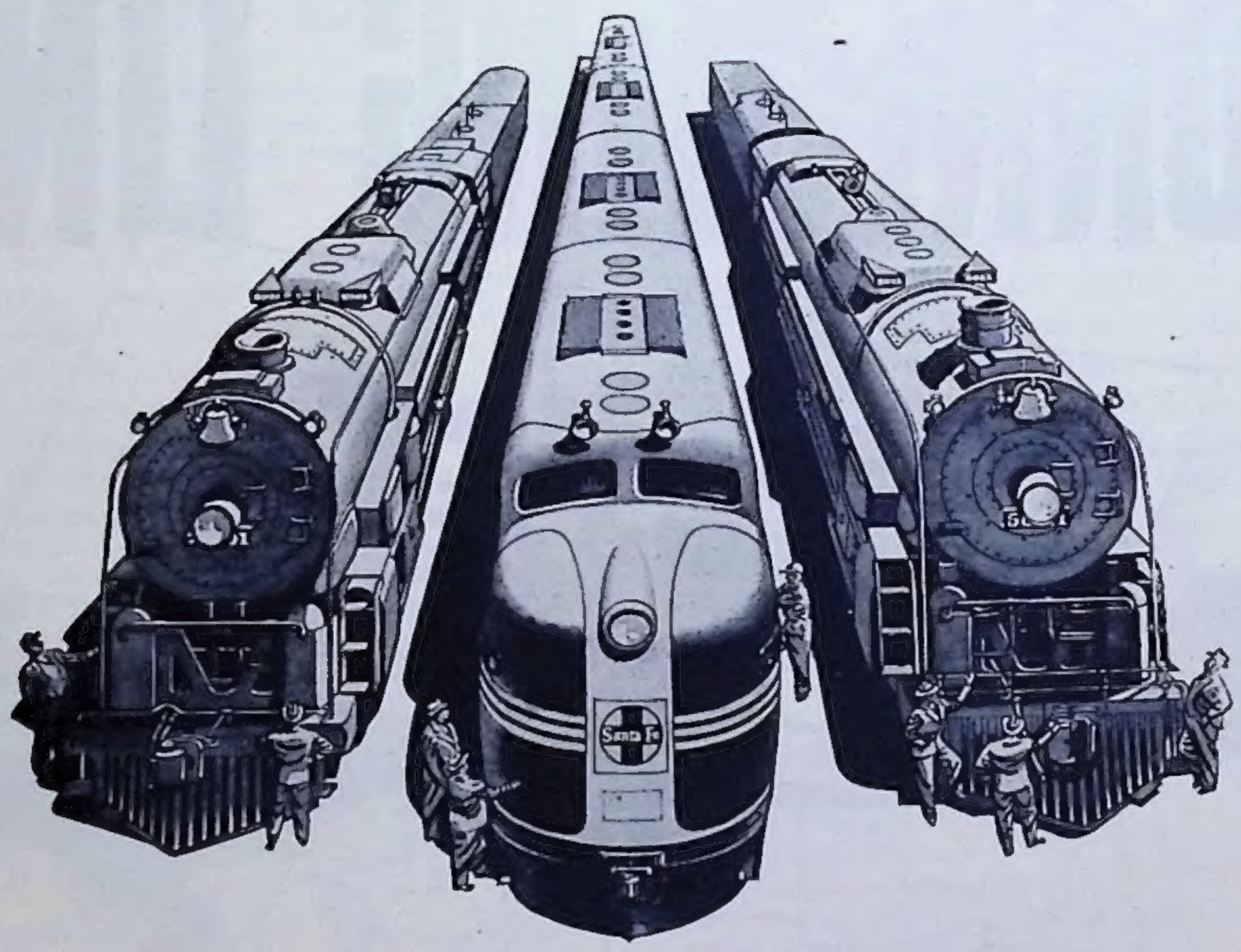
When the war ends and the new "rail-polishers" now on order are available, with their stepped-up speed and tractive power, the C&EI heavy-duty track will be fully ready to handle them.

The C&EI appreciates the interest of railfans here and abroad

C&EI

Chicago & Eastern Illinois Railroad

CONNECTING LINK



New Steel Beauties on the Santa Fe

There isn't yet the ceremony in taking delivery of a new locomotive that there is in christening a ship.

But, just the same, it's a great occasion on the Santa Fe when we receive those super-powered, high-speed locomotives so badly needed today.

For every new one means "rolling" more and longer freight trains loaded with war matériel, and more trains operated for the increasing troop movements.

The three locomotives shown above are among the first delivered of the big fleet of powerful locomotives ordered by Santa Fe. *And more are coming!*

★ *Locomotives illustrated above—new "4-8-4" steam locomotive, "2900 class"; 5400-horsepower freight Diesel; "2-10-4" steam locomotive, "5001 class." You can bet your driving wheels they'll pull a lot of trains fast!*

Santa Fe

SANTA FE SYSTEM LINES

ONE OF AMERICA'S RAILROADS—ALL UNITED FOR VICTORY

Correspondence

What I believe is the finest thing about the Southern System was neglected in your article [April TRAINS]. It is difficult to picture in words, but this road has never been looked on as a corporation in the sense that you and I term one daily. There has always been something personal about it. For a great many years the name of the engineer was carried on his locomotive along with his Shrine insigne, or his Knights of Columbus emblem, as the case happened to be.

Major Samuel E. Williams, Army Air Corps.

In your recent article on cab signals [April TRAINS], you mentioned several roads which operated certain trackage by cab-signal indication without wayside signals. How about the main line of the Santa Fe from Chicago to Ft. Madison? It operated that way in 1938 when I saw it, but you failed to mention it.

Lt. Donald D. Wright, U. S. Army.

[Several other unmentioned roads in addition to the Santa Fe use cab signals without wayside signals. We should have made it clear that the roads mentioned in TRAINS were as examples rather than as an inclusive list. The practice is becoming more common year by year.—*Ed.*]

We take our splendid systems of American transportation for granted. They are the finest in the world, monuments to America's ingenuity, ambition and inventiveness, but our people need to be educated to acquire more of a spirit of appreciation for these arteries of steel. They carry the life blood of the nation to every home and family circle in time of peace, and in time of war have proved faithful and loyal citizens to their nation in its fight for the preservation of freedom.

Rev. G. E. Appleyard, Box 165, Montpelier, Vt.

I was employed at the World Columbian Exposition in Chicago, 1892 to 1894. I recall a General Electric locomotive exhibited there and although I did not see the performance I heard that a tug-of-war was staged between the G. E. electric locomotive and a little four-wheel switcher the B&O had there working on the grounds—and that the steam engine won.

Clarence J. Root, Detroit, Mich.

[More recent tugs-of-war have shown the electric locomotive to have the advantage over a steam locomotive of comparative horsepower, due to its more constant torque.—*Ed.*]

I differ with you over the disposition of B&O locomotive No. 316, Class D-1, which received such a nice writeup in the March issue. While not in active service, it is listed on the roster of the B&O and is very much intact. The present whereabouts of D-1 is Clifton, Staten Island, on the Staten Island Rapid Transit Lines. According to Staten Island Railroad authorities, it is used for a relief engine in the B&O 26th Street yard in New York City. I can vouch for this, having seen it personally on February 22 of this year. However, the streetcar-like cab has been replaced by a conventional cab.

William Schuppner, Baltimore, Md.

Among other things in Edward P. Sanderson's fine article, "Railroads of Massachusetts" [March TRAINS], I was interested in his reference to the historic BRB&L locomotive collision of July, 1904. I was 11 years old at the time but remember it very clearly. Actually, it did not occur on the Fourth of July nor did it occur at Revere Beach. It was scheduled for the Fourth, but something like 14,000 people swarmed in droves onto the tracks, and defied all efforts of the police to hold them in check. As a result, the collision was called off. Two weeks later, on a Saturday afternoon, before a much smaller and better-behaved audience, the event was consummated.

Wendell F. Oliver, 17 West Ferry Road, Morrisville, Pa.

Book Review

It would hardly be right for us to write our own review of the new Kalmbach Publishing Co. book, "Railroad Panorama," by A. C. Kalmbach, so we'll quote from a letter by Frank Ellison, New Orleans, who apparently likes the book (or would we quote otherwise?):

"I am delighted with 'Railroad Panorama.' It is a bedtime 'must' every night—about the only time left these days for reading. This is reading I like and I read on until my wife, in exasperation, douses the light and grumbles, 'Now go to sleep!'

"I don't believe I fully appreciated your extensive and detailed knowledge of railroading until it was paraded before me in this marshaling of facts. 'I *Like* Trains,' 'Railroad Mosaic,' for a broad-angle view; 'Feather River Route,' 'Horseshoe Curve,' 'Streamliners,' 'Fastest Run' for spotlighted views . . .

"Your description of the timing of the *Pennsylvania Special* is reminiscent of my father's description of the event. Dad was quite a story teller and he built up such a romantic picture of railroad telegraphing (and for *all* railroading, for that matter) that it generated interest for O-Essing, 19 and 31 orders, work orders and the like—and a love for trains and tracks and bridge building.

"When I was a boy, the plays 'Way Down East,' 'The Old Homestead,' etc., impressed me deeply with the simple, every-day life of country living and I have sought for years for something more to bolster those pleasant memories. The chapter 'The Way Freight' now joins this limited and pleasant category. I read it four or five times in TRAINS when it appeared some years ago and have now just read it again in your book."

We have "Railroad Panorama" in stock. 224 pages of text, including outstanding articles from older issues of Trains put into permanent book form, and 32 pages of photos, mostly new. $2.75 postpaid.

Kalmbach Publishing Co.

1027 N. 7th St. Milwaukee 3, Wis.

We can't all wear wings

WE know how you feel, young fellow—that stout heart of yours is breaking because you can't be up there in those army bombers.

You couldn't help it that the medicos turned you down. You wanted to *fight* for your country.

Well, what else do you think you're doing now? You're fighting—even though your uniform is a railroad trackman's overalls.

Every time men of your courage and character apply for work that will help shorten the war, we of The Milwaukee Road learn anew what makes this nation invincible.

Out on the endless plains of the Dakotas, or in the rugged mountains of Montana or Washington, the sound of heavy war trains rolling over your stretch of track is like the roar of a bomber to your ears.

You don't wear wings. But we thought the country you're serving ought to know about you.

And we can tell you that over 5,000 men and women of The Milwaukee Road in the armed services consider you their kind of man.

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"They should not have taken a railroad man for the Army unless he, himself, clamored for military service. He is in as fine a military place as he can ever occupy when he is helping run the railroads." Colonel J. Monroe Johnson, Interstate Commerce Commission.

THE MILWAUKEE ROAD

11,000-MILE SUPPLY LINE FOR WAR AND HOME FRONTS